SOIL SURVEY OF

Baca County, Colorado

United States Department of Agriculture
Soil Conservation Service
and
Forest Service
In cooperation with
Colorado Agricultural Experiment Station

Issued September 1973

Major fieldwork for this soil survey was done in the period 1961–1963. Soil names and descriptions were approved in 1966. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1963. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Southeastern Baca, Two Buttes, and Western Baca Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for agriculture, industry, and recreation.

Locating Soils

All the soils of Baca County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described, the page for the range site in which the soil has been placed, and the windbreak suitability group.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and windbreak groups.

Foresters and others can refer to the section "Management of Soils for Windbreaks," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Management of Soils for Wildlife."

Ranchers and others can find, under "Management of Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect recreational sites in the section "Recreational Use of Soils."

Engineers and builders can find, under "Engineering Uses of Soils," tables that give engineering descriptions of the soils in the county and that name soil features that affect engineering practices and structures.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Baca County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county in the section "General Nature of the County."

Cover picture: Broomcorn on Dalhart sandy loam, 0 to 1 percent slopes.

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SOIL SURVEY OF BACA COUNTY, COLORADO

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH THE COLORADO AGRICULTURAL EXPERIMENT STATION

BACA COUNTY is in the southeastern corner of Colorado (fig. 1). It is bordered on the south by Oklahoma and New Mexico and on the east by Kansas. It is about 55 miles from east to west and about 44 miles from north to south and has a total land area of about 1,641,600 acres.

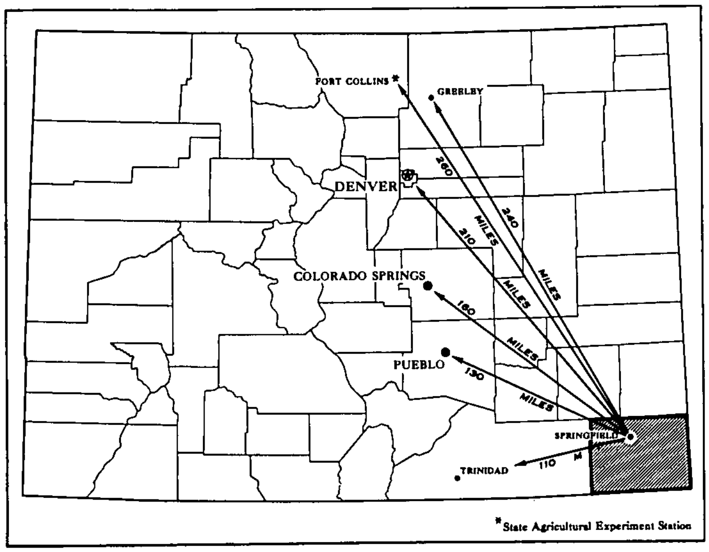

Figure 1.—**Location of Baca County in Colorado.**

In 1964 about half of Baca County was used as nonirrigated cropland, and an additional 20,000 acres was used as irrigated cropland. Most of the remaining acreage was used for grazing of livestock. Baca County is important for the production of broomcorn, grain sorghum, and wheat. In most years it ranks first or second among all counties in the United States in the production of broomcorn, and in 1961 produced about one-third of the total U.S. broomcorn crop.

The county has a semiarid climate with an average total annual precipitation ranging from about 12 inches in the drier areas of the northwestern corner to above 17 inches on the eastern side. Periodic severe droughts of 1 to 3 years are common, and crop failure and duststorms have accompanied these periods. Advancements in farming methods and equipment, accompanied with adjustments in land use and the development of pump irrigation from deep wells, have greatly stabilized the agriculture of the county in recent years.

Approximately 205,000 acres, or 50 percent of the Comanche National Grassland, lies within Baca County. These lands, part of the "dust bowl" of the 1930's, were purchased by the United States late in that decade. The federal acquisition program was directed toward: (1) protecting the lands unsuitable for cultivation by returning them to a perennial forage cover; (2) aiding the people who chose to stay on the land through development and maintenance of a suitable livestock-based economy; and (3) resettling those people that were economically stranded on the land.

In 1938 the Soil Conservation Service was assigned the management of these lands, and subsequently thousands of acres of soil were stabilized through reseeding. About half of this area has been reseeded since the land has been under federal ownership. In 1954, management was transferred to the Forest Service. The area was designated a National Grassland and became a part of the National Forest System in 1961.

Under Forest Service administration the current rate of reseeding averages 1,000 acres per year. In 1970, nearly 6,000 head of cattle were permitted to graze for a total of 35,000 animal unit months. About 225 water guzzlers for scaled quail have been installed, nearly 200 acres have been planted to trees and brush for wildlife habitat, some stock ponds have been fenced for duck nesting, and a few homestead sites have been fenced to protect the trees for wildlife. There were approximately 5,000 recreation visitor days in 1970; 1,300 were for picnicking and camping, 3,100 were for hunting, 400 for sightseeing and general enjoyment, and 200 for scientific, archeological, and nature study purposes.

The Comanche National Grassland within Baca County is principally on the Vona-Manter-Dalhart, Travessilla-Kim, and Baca-Wiley soil associations.

The Colorado State Agricultural Experiment Station has a branch station about 7 miles west and 1 mile south of Springfield. This station does research primarily on cropping and erosion control methods and systems.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in Baca County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they

had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series (*10*)[1]. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Dalhart and Manter, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Dalhart sandy loam, 0 to 1 percent slopes, is one of several phases within the Dalhart series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Baca County: soil complexes and undifferentiated soil groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen, for example, Minnequa-Manvel complex.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. Wiley soils, eroded, is an undifferentiated group in this county.

In most areas surveyed, there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Dune land and Rough stony land are two land types in Baca County.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

The general soil map at the back of this report shows, in color, the soil associations in Baca County. A soil association is a landscape that has a distinctive pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

In this section the seven associations and the major soils in the association are discussed. Terms for texture used in the title of an association apply to the surface

[1] Italic numbers in parentheses refer to Literature Cited, page 51.

layer. For example, in the title of association 1, the words "silt loams" refer to texture of the surface layer.

1. *Richfield-Ulysses-Norka association*

Deep, nearly level to gently undulating silt loams on loess uplands

This soil association is on the nearly level, well-drained uplands near the eastern boundary of the county. The soils developed in silty eolian loess.

This association occupies about 5 percent of the county. Richfield soils make up about 35 percent of the association, Ulysses soils about 25 percent, and Norka soils about 15 percent. The remaining 25 percent is Goshen soils in swales, Colby soils in small steep areas, and Campo soils.

Richfield soils are deep, well-drained, nearly level, dark-colored silt loams. They have a strongly structured silty clay loam to clay subsoil. They occupy the most nearly level part of the association. Like the Richfield, the Ulysses soils are deep, well drained, and dark colored. They also have a silt loam surface layer, but their subsoil is not so strongly structured or so clayey. They are on the very gently undulating part of the landscape and commonly are on convex topography. Norka soils are in convex, undulating areas. They are like the Richfield soils except that the combined thickness of their surface layer and subsoil is much less.

All of this association is in the part of the county that receives the most rainfall, and it is considered the association best suited to nonirrigated production of wheat and grain sorghums. Some of the association is irrigated, and although wheat and grain sorghums have been the primary crops, sugar beets are gaining rapidly in acreage. The minor part of the association not used for cultivated crops is used for grazing of livestock. Blue grama and buffalograss furnish most of the forage.

Where these soils are cultivated, soil blowing is the main hazard. Conserving moisture is essential to crop production, and unless the land is irrigated, a summer fallow system of farming is required. Stubble-mulch tillage and stripcropping have proved successful in controlling soil blowing.

2. *Baca-Wiley association*

Deep, nearly level to sloping clay loams and loams on loess uplands

The nearly level to sloping soils in this association are on uplands throughout most of the northern two-thirds of the county. The soils developed in loamy eolian loess.

This association occupies about 38 percent of the county. Baca soils make up about 40 percent of the association, and Wiley soils about 38 percent. The remaining 22 percent is relatively large areas of Campo and Harbord soils and small areas of Colby, Bankard, Glenberg, and Wages soils adjacent to streams and drainageways.

Baca soils are nearly level, light-colored light clay loams. Their subsoil is typically clay loam and silty clay loam and has a strongly developed blocky structure. Baca soils are leached of lime in the upper few inches, but are strongly calcareous in the lower part of the subsoil. Wiley soils have a loam surface layer and a silty clay loam and silt loam subsoil. Wiley soils are generally calcareous throughout. They are nearly level and sloping and commonly are slightly more sloping than Baca soils.

About 70 percent of the association is cultivated. Wheat and sorghum are the main crops. Most of the cultivated acreage is dryfarmed, but in some areas, deep wells provide water for irrigation, and in these areas, sugar beet production is increasing. Areas not cultivated are used for grazing livestock. Blue grama and buffalograss are common.

During periods of drought, many crops fail and the soils are subject to a severe hazard of erosion. Stubble-mulch tillage, stripcropping, and emergency tillage with chisel-type implements are all used with varying degrees of success in controlling soil blowing.

3. *Vona-Manter-Dalhart association*

Deep, nearly level to gently undulating sandy loams and loamy sands on uplands

This soil association consists of deep, well-drained sands that occupy extensive areas in the southern part of the county.

This association occupies about 34 percent of the county. Vona soils make up about 30 percent of the association, Manter soils about 15 percent, and Dalhart soils about 15 percent. The remaining 40 percent is extensive areas of Otero soils on and adjacent to slopes above drainageways, large areas of Tivoli soils that are mostly near the Cimarron River in the southeastern corner of the county, isolated areas of Campo, Baca, and Wiley soils, and areas of Bankard soils and Gravelly land.

Vona soils are light-colored sandy loams and loamy sands that have a sandy loam subsoil. They are mostly in the gently undulating part of the association. Manter soils are like the Vona soils, but they are darker colored and are in the more smoothly sloping areas. Dalhart soils are also dark colored, but unlike Vona soils, they have a finer textured, dominantly sandy clay loam subsoil. Dalhart soils are the most nearly level and occupy the flatter areas of the association.

The part of the association that is sandy loam is farmed extensively, and the part of the association that is loamy sand and sand is used mostly for grazing. Broomcorn, sorghum, and wheat are the common crops. Areas that are grazed have a vegetative cover of blue grama, side-oats grama, sand dropseed, and sand sage. Some small areas are irrigated; broomcorn and grain sorghum are the main crops.

Where these soils are cultivated, soil blowing is the main erosion hazard. Stripcropping is practiced extensively to help control soil blowing.

4. *Travessilla-Kim association*

Shallow, strongly sloping stony sandy loams on sandstone breaks and bluffs and deep, dominantly gently sloping loams on bordering foot slopes

This association occurs in the western part of the county where sandstone outcrops and bluffs dominate the landscape. The topography ranges from rough and broken near the outcrops to gently sloping on the lower part of foot slopes and fans.

This association occupies about 8 percent of the county. Travessilla soils make up about 50 percent of the asso-

ciation, and Kim soils about 15 percent. The remaining 35 percent is extensive areas of Rough stony land in the most steeply sloping part of the association; fairly extensive areas of McCook and Nunn soils on terraces adjacent to streams; and small areas of Apache and Capulin soils and of basalt flow, which has covered the sandstone, near the southwestern corner of the county.

Travessilla soils are shallow, strongly sloping, light-colored stony sandy loams (fig. 2). They average less than 15 inches in depth. Kim soils are light-colored loams that occupy the foot slopes and fans below Travessilla soils.

Nearly all of this association is used as range; blue grama, side-oats grama, and little bluestem are the major grasses. A few small areas on the terraces are cultivated, primarily for feed crops.

Controlling water erosion and maintaining adequate cover vegetation are the major concerns in managing the soils. Control of grazing is important to prevent gullying.

Figure 2.—**Travessilla-Kim association. Kim loam, 0 to 9 percent slopes, and Nunn clay loam in foreground; shallow Travessilla stony sandy loam in background.**

5. Wiley-Potter association

Deep and shallow, moderately sloping to strongly sloping loams and gravelly loams on uplands

This association occurs along Two Buttes, Horse, and Bear Creeks and other major drainageways in the northeastern part of the county. Slopes range from 3 to nearly 25 percent but are mostly 4 to 9 percent. The soils of this association overlie many different types of parent material, such as Ogallala outwash, Dakota sandstone, and loess. Rock crops out in small areas scattered throughout the association.

This association occupies about 7 percent of the county. Wiley soils make up about 50 percent of the association, and Potter soils about 25 percent. The remaining 25 percent is deep limy, light-colored Harvey soils, and

small areas of Colby and Harbord soils on the gentler slopes, Travessilla soils on the steeper slopes, and McCook and Wages soils along streams.

Wiley soils are light-colored loams that have a silt loam and silty clay loam subsoil. They occupy the more gently sloping areas. Potter soils are shallow, light-colored gravelly loams. They are strongly calcareous and occupy the more strongly sloping areas.

A small part of this association is cultivated, but the major part is in native range. The vegetation is mainly yucca, side-oats grama, and blue grama. Proper range management practices, such as deferred grazing, help control erosion.

6. *Minnequa-Manvel-Penrose association*

Deep to shallow, nearly level to sloping loams on limestone and marl uplands

Limestone outcrops distinguish this association. The topography is nearly level to sloping. Slopes range from 1 to 9 percent.

This association occupies about 5 percent of the county. Minnequa soils make up about 40 percent of the association, Manvel soils about 35 percent, and Penrose soils about 15 percent. The remaining 10 percent is Wiley and Colby soils on the gentler slopes and Wages and McCook soils on terraces.

Minnequa soils are strongly calcareous, light-colored loams. Limestone chips are common throughout the profile, and consolidated limestone occurs between depths of 20 and 36 inches. Manvel soils are deep, strongly calcareous, light-colored loams. Penrose soils are light-colored channery loams that are very strongly calcareous and are underlain by consolidated limestone at a depth of less than 20 inches.

Most of this association is used for grazing, but small areas of the deep soils are planted to wheat and sorghum. The soils in this association are poorly suited to crop production. Blue grama and buffalograss are the primary grasses, and snakeweed is common on the shallower soils. Deferred grazing helps to maintain range condition.

7. *Otero-Potter association*

Deep and shallow, undulating and rolling loams and gravelly loams on uplands

This soil association is an area of low, irregular relief. The overall gently undulating topography is broken by nearly level flats, shallow drainageways with steep side slopes, and a few rolling areas.

This association occupies about 3 percent of the county. The Otero soils make up about 60 percent of the association, and the Potter soils about 30 percent. The remaining 10 percent is nearly level and sloping Vona soils, Tivoli soils in steeper areas, and Dalhart soils on flats or in concave areas.

Otero soils are deep, undulating, light-colored, dominantly sandy loams. They are limy throughout. Potter soils are strongly calcareous, shallow, light-colored gravelly loams that overlie caliche. They are mostly on the stronger slopes, particularly on side slopes to drainageways.

Almost all of this association is in native range. The vegetation is mainly sand sage, yucca, and mid and tall grasses. Proper range management practices, such as rotation and deferred grazing, are necessary to help control soil blowing.

Descriptions of the Soils

In this section the soils of Baca County are described in detail. The procedure is to describe first the soil series and then the mapping units in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs.

The description of the soil series includes a description of a profile that is considered representative of all the mapping units in the series. If the profile of a given mapping unit differs from this typical profile, the differences are stated in the description of the mapping unit, unless they are apparent from the name of the mapping unit. The colors described in the typical profile are those of dry soil, unless otherwise stated. Many of the terms used in describing soil series and mapping units are defined in the Glossary, and some are defined in the section "How This Survey Was Made."

The approximate acreage and proportionate extent of the soils are shown in table 1. At the back of this soil survey is the "Guide to Mapping Units," which lists the mapping units in the county and shows the capability unit, range site, and windbreak group each mapping unit is in and the page where some of these groups are described.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Apache stony loam	1, 400	0. 1
Baca clay loam, 0 to 1 percent slopes	156, 141	9. 5
Baca clay loam, 1 to 3 percent slopes	75, 003	4. 6
Baca clay loam, 3 to 5 percent slopes	21, 353	1. 3
Bankard sand	19, 389	1. 2
Campo Clay loam	146, 554	8. 9
Capulin loam	1, 345	. 1
Colby silt loam, 0 to 1 percent slopes	1, 252	. 1
Colby silt loam, 1 to 3 percent slopes	6, 942	. 4
Colby silt loam, 3 to 9 percent slopes	1, 634	. 1
Colby silt loam, terrace, 0 to 2 percent slopes	1, 310	. 1
Dalhart loamy sand, 0 to 1 percent slopes	1, 960	. 1
Dalhart loamy sand, 1 to 3 percent slopes	2, 740	. 2
Dalhart sandy loam, 0 to 1 percent slopes	52, 898	3. 2
Dalhart sandy loam, 1 to 3 percent slopes	15, 082	. 9
Dune land	590	(1)
Glenberg sandy loam	16, 080	1. 0
Goshen loam, 0 to 1 percent slopes	2, 115	. 1
Goshen loam, 1 to 3 percent slopes	610	(1)
Gravelly land	17, 596	1. 1

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Area	Extent	Soil	Area	Extent
	Acres	*Percent*		*Acres*	*Percent*
Harbord loam, 0 to 1 percent slopes	9, 091	. 6	Tivoli sand	31, 980	2. 0
Harbord loam, 1 to 3 percent slopes	47, 088	2. 9	Tivoli-Dune land complex	13, 790	. 8
Harbord loam, 3 to 5 percent slopes	14, 582	. 9	Travessilla stony sandy loam	61, 985	3. 8
Harvey loam, 1 to 5 percent slopes	21, 743	1. 3	Ulysses and Norka silt loams, 0 to 1 percent slopes	16, 644	1. 0
Kim loam, 0 to 9 percent slopes	13, 380	. 8	Ulysses and Norka silt loams, 1 to 3 percent slopes	7, 610	. 5
Manter and Vona sandy loams, 0 to 1 percent slopes	18, 761	1. 1	Vona loamy sand, 0 to 3 percent slopes	52, 580	3. 2
Manter and Vona sandy loams, 1 to 3 percent slopes	133, 123	8. 1	Vona sandy loam, 3 to 5 percent slopes	24, 310	1. 5
McCook loam, 0 to 1 percent slopes	2, 910	. 2	Vona soils, eroded	13, 829	. 8
McCook loam, 1 to 3 percent slopes	400	(1)	Wages loam	37, 465	2. 3
Minnequa-Manvel complex	41, 580	2. 5	Wiley loam, 0 to 1 percent slopes	85, 268	5. 2
Nunn clay loam	1, 830	. 1	Wiley loam, 1 to 3 percent slopes	158, 683	9. 7
Otero sandy loam, 0 to 3 percent slopes	77, 267	4. 7	Wiley loam, 3 to 5 percent slopes	28, 279	1. 7
Otero sandy loam, 3 to 9 percent slopes	36, 008	2. 2	Wiley loam, 5 to 9 percent slopes	6, 940	. 4
Otero-Potter complex	17, 186	1. 0	Wiley soils, eroded	19, 190	1. 2
Penrose channery loam	10, 020	. 6	Intermittent lakes, stream channels, and water	9, 300	. 6
Potter gravelly loam	32, 530	2. 0			
Richfield silt loam, 0 to 1 percent slopes	23, 464	1. 4			
Rough stony land	27, 110	1. 7	Total	1, 641, 600	100. 0
Thedalund silty clay loam	3, 680	. 2			

[1] Less than 0.1 percent.

Apache Series

The Apache series consists of moderately steep to steep, somewhat excessively drained, dark-colored soils that developed over basalt rock in the southwestern part of the county.

In a typical profile the surface layer, about 7 inches thick, is grayish-brown stony loam. It is strongly calcareous. The underlying material, about 8 inches thick, is grayish-brown, very strongly calcareous gravelly loam. Basalt fragments are common in this layer. Below a depth of about 15 inches is basalt rock.

Apache soils have moderate permeability, but low available water capacity and rapid runoff.

None of the acreage is cultivated. The vegetation is mainly big bluestem, side-oats grama, and blue grama.

Typical profile of Apache stony loam (2,480 feet west and 45 feet south of NE. corner, sec. 20, T. 33 S., R. 50 W.):

A1—0 to 7 inches, grayish-brown (10YR 5/2) stony loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; strongly calcareous, pH 7.6; clear, smooth boundary.

C—7 to 15 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; massive; slightly hard when dry, friable when moist; many lime-coated rocks; very strongly calcareous, pH 8.0; clear, smooth boundary.

R—15 inches +, basalt rock.

Apache soils range from 8 to 20 inches in depth to basalt rock. The A horizon is loam or stony loam, and the C horizon ranges from gravelly loam to gravelly clay loam.

Apache stony loam (5 to 20 percent slopes) (Ap).—This soil occurs on the edge of basalt mesas. There are many outcrops of basalt rocks. Slopes are moderately steep to steep, and runoff is rapid.

Included in mapping were small areas of gently sloping Capulin loam.

None of the acreage is cultivated. The main vegetation is blue grama, side-oats grama, and big bluestem. Deferred grazing and rotation grazing help control soil blowing and water erosion. (Capability unit VIIs-1, nonirrigated; Basalt Breaks range site)

Baca Series

The Baca series consists of deep, nearly level and gently sloping, well-drained, light-colored soils on uplands.

In a typical profile the surface layer, about 5 inches thick, is light brownish-gray clay loam, free of lime, and easily worked. The subsoil, about 19 inches thick, is clay loam or silty clay loam. The upper part of the subsoil is grayish brown and is slightly darker than the lower part. The lower part of the subsoil is calcareous and in most places has white lime spots. The underlying material is pale brown friable silt loam. It contains lime and is easily penetrated by plant roots.

Baca soils have moderate permeability and high available water capacity. They are high in natural fertility.

Most of the acreage is cultivated. Winter wheat is the most widely grown crop. Where the soils are irrigated, wheat, sorghum, and sugar beets are grown. In areas used for range, the principal native plants are blue grama and buffalograss.

Typical profile of Baca clay loam (230 feet east of NW. corner, sec. 5, T. 32 S., R. 48 W.):

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) light clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; many roots; noncalcareous, pH 7.8; clear, smooth boundary.

B2t—5 to 15 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist; many roots; thin nearly continuous clay skins; noncalcareous in upper

part and slightly calcareous in lower part, pH 8.4; clear, smooth boundary.

B3ca—15 to 24 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard when dry, friable when moist; very thin patchy clay skins; very strongly calcareous, pH 8.6; clear, smooth boundary.

Cca—24 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; lime spots are plentiful; very strongly calcareous, pH 8.9.

The depth to lime ranges from 5 to 14 inches. In uncultivated areas, the A1 horizon is commonly silt loam. The texture of the B2t horizon ranges from clay loam to clay.

Baca clay loam, 0 to 1 percent slopes (BaA).—This soil occurs mostly in the northern half of the county. Where this soil is not cultivated, the surface layer is silt loam about 2 inches thick.

Included in mapping were small areas of Baca clay loam, 1 to 3 percent slopes; Wiley loam, 0 to 1 percent slopes; Harbord loam in the northern half of the county; and Ulysses and Norka silt loams in the eastern part of the county.

This soil has slow surface runoff and moderate permeability. It is high in natural fertility.

Most of the acreage is cultivated. Winter wheat and sorghum are the main crops in both dryland and irrigated areas. Soil blowing is the major hazard. Stubble mulching and stripcropping help control soil blowing in dryland and irrigated areas. Fertilizing and proper water management help improve crop production and control erosion. During periods of drought, deep listing and chiseling help keep the surface rough and reduce erosion in dryland areas. Deferred and rotation grazing help maintain range condition. (Capability unit I–1, irrigated, and capability unit IVe–1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Baca clay loam, 1 to 3 percent slopes (BaB).—This soil occurs throughout the county, but mainly in the northern half.

Included in most mapped areas of this soil were small areas of Wiley loam; small areas of Harbord loam in the northern half of the county; and small areas of Ulysses and Norka silt loams along the eastern boundary of the county.

Most of the acreage is cultivated. Wheat and sorghum are the main crops in dryland and irrigated areas. Soil blowing is the major hazard. Stubble mulching and contour farming help control soil blowing on cultivated areas. Land leveling and proper water management are suggested on irrigated land. During periods of drought, deep listing and chiseling help keep the surface rough and reduce erosion. Deferred grazing helps prevent soil blowing on range. (Capability unit IIe–1, irrigated, and capability unit IVe–1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Baca clay loam, 3 to 5 percent slopes (BaC).—This soil occurs in small areas throughout the county. It has the profile described as typical for the series except that the surface layer is less than 5 inches thick.

453-632—73——2

Included in mapping were small areas of Wiley loam and Colby silt loam. Included in the southwestern part of the county are small areas where sandstone is at a depth of 30 inches and a few places where sandstone crops out.

Surface runoff is more rapid on this soil than it is on the gently sloping Baca soils. If the soil is not protected, water erosion can take place. Soil blowing is the major hazard.

Because soil blowing and water erosion are hazards, this soil is best suited to grasses, although nearly 50 percent of the acreage is now cultivated. Blue grama and buffalograss are the principal grasses, and wheat and sorghum are the main crops. Contour stripfarming and stubble mulching help control soil blowing and water erosion, as do deferred grazing and contour furrowing. (Capability unit IIIe–2, irrigated, and capability unit IVe–2, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Bankard Series

The Bankard series consists of nearly level, excessively drained, light-colored sands on flood plains and low terraces along the major drainageways.

In a typical profile the surface layer, about 5 inches thick, is pale-brown sand that is strongly calcareous. The underlying material below a depth of 5 inches is brown sand that is stratified with loamy sand in places. It extends to a depth of more than 60 inches.

Bankard soils are excessively drained, are rapidly permeable, and have low available water capacity. They are very susceptible to soil blowing. They are low in natural fertility.

Most of the acreage is in native vegetation. The vegetation is mainly sand sage and sand dropseed.

Typical profile of Bankard sand (1,584 feet east and 784 feet south of NW. corner, sec. 36, T. 29 S., R. 43 W.):

A1—0 to 5 inches, pale-brown (10YR 6/3) sand, dark brown (10YR 4/3) when moist; single grain; loose when dry, very friable when moist; strongly calcareous, pH 7.5; abrupt, smooth boundary.

C—5 to 60 inches, brown (10YR 5/3) sand, dark brown (10YR 4/3) when moist; single grain; loose when dry, very friable when moist; strongly calcareous, pH 8.0.

These soils have a wide range of depth and stratification. They are frequently flooded and are calcareous throughout.

Bankard sand (0 to 1 percent slopes) (Bk).—This soil occurs along streams throughout the county. In some places is a thin surface layer of sandy loam or loam. Below a depth of about 5 inches is highly stratified loamy sand and sand.

Included in mapping were small areas of Glenberg sandy loam.

This soil is excessively drained. Surface runoff is slow, internal drainage is rapid, and available water capacity is low. During periods of hard thunderstorm, this soil is subject to overflow.

All of the acreage is in native range and has some use for grazing. Sand sage and sand lovegrass are the principal grasses. Native vegetation is needed to help control water erosion and soil blowing. (Capability unit VIIw–1, nonirrigated)

Campo Series

The Campo series consists of deep, nearly level, moderately dark colored clay loams. These soils occur on uplands in all parts of the county.

In a typical profile the surface layer, about 4 inches thick, is light brownish-gray clay loam that is easily worked. The subsoil is brown clay, silty clay, and silty clay loam about 36 inches thick. It is free of lime in the upper 14 inches. The lower part has lime spots and is calcareous. Below a depth of about 40 inches is very pale brown silty clay loam that is very strongly calcareous.

Campo soils are well drained. They absorb water slowly and have a high available water capacity. Because the slopes are nearly level and concave, these soils receive a small amount of extra moisture from surface runoff from surrounding soils.

Most of the acreage is cultivated. Wheat and sorghum are the main crops. In areas used for range the vegetation is mainly blue grama and buffalograss.

Typical profile of Campo clay loam (650 feet west and 20 feet south of NE. corner, sec. 10, T. 33 S., R. 47 W.):

A1—0 to 4 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium to fine, granular structure; hard when dry, firm when moist; noncalcareous; clear, smooth boundary.

B1—4 to 6 inches, pale-brown (10YR 6/3) silty clay, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; thin, continuous clay skins; noncalcareous; clear, smooth boundary.

B2t—6 to 18 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure that parts to strong, medium to fine, subangular blocky; hard when dry, firm when moist; moderate, continuous clay skins; noncalcareous; clear, smooth boundary.

B3ca—18 to 40 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; common lime spots ¼ to ⅛ inch in diameter; very strongly calcareous; clear, smooth boundary.

Cca—40 to 60 inches, very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) when moist; very weak, coarse, subangular blocky structure; hard when dry, friable when moist; moderately limy; very strongly calcareous; gradual, smooth boundary.

The A horizon ranges from 3 to 9 inches in thickness. In some places, the upper 1 to 2 inches of the A horizon is silt loam. The B2t horizon ranges from heavy silty clay loam to clay in texture.

Campo clay loam (0 to 1 percent slopes) (Ca).—This soil occurs in all parts of the county on concave topography.

Included in mapping were small areas of Baca clay loam and Wiley loam, and in the southern half of the county, small areas of Dalhart sandy loam.

Because of the concave topography of this soil, there is very little surface runoff, permeability is moderately slow to slow, and available water capacity is high. Soil blowing is the major hazard.

Nearly 60 percent of the acreage is cultivated. Wheat and sorghum are the main crops in both dryland and irrigated areas. Stubble mulching and stripcropping help to control soil blowing in dryfarmed areas. Where the soil is irrigated, land leveling is usually necessary for uniform application of water. On range, deferred grazing helps maintain and improve the vegetation and control soil blowing. (Capability unit IIs–1, irrigated, and capability unit IVe–1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Capulin Series

The Capulin series consists of deep, nearly level, well-drained, dark-colored loams on basalt mesa tops. These soils are underlain by basalt and have many basalt fragments on the surface.

In a typical profile the surface layer, about 7 inches thick, is dark grayish-brown loam that is noncalcareous. The subsoil, about 27 inches thick, is grayish-brown and light brownish-gray clay loam. It is strongly calcareous in the lower part. Below a depth of about 34 inches is pale-brown loam that has many lime concretions.

Capulin soils have moderate permeability and high available water capacity. They are high in natural fertility.

The entire acreage is in native range, but because it is on mesa tops, accessibility to cattle is somewhat restricted. Little bluestem and side-oats grama are the principal grasses.

Typical profile of Capulin loam (11 feet north and 2,540 feet west of SE. corner, sec. 17, T. 33 S., R. 50 W.):

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, friable when moist; few basalt pebbles; noncalcareous, pH 7.6; clear, smooth boundary.

B2t—7 to 20 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky; hard when dry, very firm when moist; thin, patchy clay skins; strongly calcareous, pH 8.0; clear, wavy boundary.

B3ca—20 to 34 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard when dry, friable when moist; thin, patchy clay skins; lime in mycelium and concretions; strongly calcareous, pH 8.0; gradual, wavy boundary.

Cca—34 to 60 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; hard when dry, friable when moist; many lime concretions; strongly calcareous, pH 8.0; gradual, wavy boundary.

The A horizon ranges from 3 to 9 inches in thickness and from loam to clay loam in texture. From 3 to 10 percent of the A horizon is basalt fragments. The B2t horizon ranges from loam to clay loam in texture.

Capulin loam (0 to 1 percent slopes) (Cn).—This soil occurs on the tops of basalt mesas in the southwestern part of the county.

Included in mapping were small areas of Apache stony loam on the outer edges of the mesa tops.

This soil has medium surface runoff, moderate permeability, and high available water capacity.

The entire acreage is used as range. Little bluestem and side-oats grama are the common grasses. Deferment and rotation grazing are necessary to maintain and improve the vegetative cover. (Capability unit IIIc–1, nonirrigated; Basalt Loam range site; Loamy windbreak suitability group)

Colby Series

The Colby series consists of deep, well-drained, light-colored, limy silt loams that developed in calcareous loamy and silty material. These soils are on uplands and terraces.

In a typical profile the surface layer, about 6 inches thick, is light brownish-gray silt loam. The underlying material is pale-brown silt loam that is soft when dry and very friable when moist.

Colby soils have moderate permeability and high available water capacity. They are high in natural fertility.

About 90 percent of the acreage is cultivated. Wheat and sorghum are the main crops in both dryland and irrigated areas. In areas used as range, the vegetation is mainly blue grama and buffalograss.

Typical profile of Colby silt loam (60 feet west and 49 feet south of NE. corner, sec. 22, T. 28 S., R. 42 W.):

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist; strongly calcareous, pH 7.6; clear, smooth boundary.

AC—6 to 12 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; weak, coarse, prismatic structure; soft when dry, very friable when moist; strongly calcareous, pH 7.8; clear, smooth boundary.

C—12 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive; soft when dry, very friable when moist; very strongly calcareous, pH 8.0; clear, smooth boundary.

The A horizon ranges from sandy loam to silt loam in texture. The material below a depth of 40 inches is commonly silt loam, but in many places on terraces it is stratified and quite variable in texture.

Colby silt loam, 0 to 1 percent slopes (CoA).—This soil occurs mainly as small areas in the northeastern quarter of the county.

Included in mapping were small areas of Wiley and Harvey loams, and near Walsh, small areas of Manter and Vona sandy loams.

Surface runoff on this soil is slow, permeability is moderate, and available water capacity is high. Extreme care must be taken to prevent soil blowing.

Nearly all of the acreage is cultivated. The response to irrigation is excellent. Wheat and sorghum are the main crops. During periods of drought, deep chiseling helps conserve moisture, but because the material beneath the surface layer is friable, it does not help so much as on soils that contain more clay. Proper water management and use of fertilizer are necessary for maintaining soil fertility. Stubble mulching and stripcropping help to improve cover. Deferred grazing helps maintain and improve grass cover. (Capability unit I–1, irrigated, and capability unit IVe–1, nonirrigated Loamy Plains range site; Loamy windbreak suitability group)

Colby silt loam, 1 to 3 percent slopes (CoB).—This soil occurs as small areas in the northeastern quarter of the county.

Included in mapping were areas of Wiley loam near Two Buttes, small areas of Ulysses and Norka silt loams along the eastern boundary of the county, and small areas of Manter and Vona sandy loams.

Surface runoff on this soil is medium, permeability is moderate, and available water capacity is high. The hazard of soil blowing is high.

Most of the acreage is cultivated. Wheat and sorghum are the main crops. Leveling makes uniform application of irrigation water easier. Fertilizing increases production. During periods of drought, deep chiseling helps conserve moisture, but not to the degree it does on soils containing more clay. Contouring, stripcropping, and stubble mulching help control soil blowing. On rangeland, good management practices, such as deferred and rotation grazing, are necessary to control soil blowing. (Capability unit IIe–1, irrigated, and capability unit IVe–1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Colby silt loam, 3 to 9 percent slopes (CoD).—This soil occurs as small areas in the northeastern quarter of the county.

Included in mapping were small areas of Wiley loam, and in the vicinity of Walsh, minor areas of Manter and Vona sandy loams.

This soil takes in water at a moderate rate, but surface runoff is rapid. The hazard of soil blowing is severe, and water erosion is active in nearly all cultivated areas.

Although half the acreage is cultivated, mainly to winter wheat and grain sorghum, this soil is best suited to grass. Blue grama and buffalograss are the main grasses. Because slopes are steep, it is difficult to establish and maintain a cover crop. Stubble mulching, stripcropping, and contouring help control soil blowing, but reseeding to grass is the only reliable way to control erosion. On range, deferment and rotation of grazing are necessary for maintaining cover and controlling soil blowing and water erosion. (Capability unit VIe–1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Colby silt loam, terrace, 0 to 2 percent slopes (CtA).—This soil occupies small stream terraces in the northern half of the county. It has the profile described as typical for the series except that it is less silty and the subsoil is more stratified. In some places, sand or clay loam lenses are in the substrata, and in some places, gravel.

Included in mapping were minor areas of Wages loam and, in the western part of the county, a few small areas of McCook loam.

Surface runoff on this soil is slow, and available water capacity and natural fertility are high. Where the acreage is cultivated, extreme care must be taken to prevent soil blowing.

Most of the acreage is cultivated. Wheat and sorghum are the main crops on both dryland and irrigated areas. During periods of drought, deep listing and chiseling are beneficial for roughing the surface. Leveling and fertilizing are necessary on irrigated soil. Stubble mulching and stripcropping help control soil blowing. Deferred grazing will help maintain cover on rangeland. (Capability unit I–1, irrigated, and capability unit IVe–1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Dalhart Series

The Dalhart series consists of deep, nearly level to gently sloping, dark-colored loamy sands and sandy loams on uplands (fig. 3).

In a typical profile the surface layer, about 8 inches thick, is dark-brown loamy sand that is easily worked

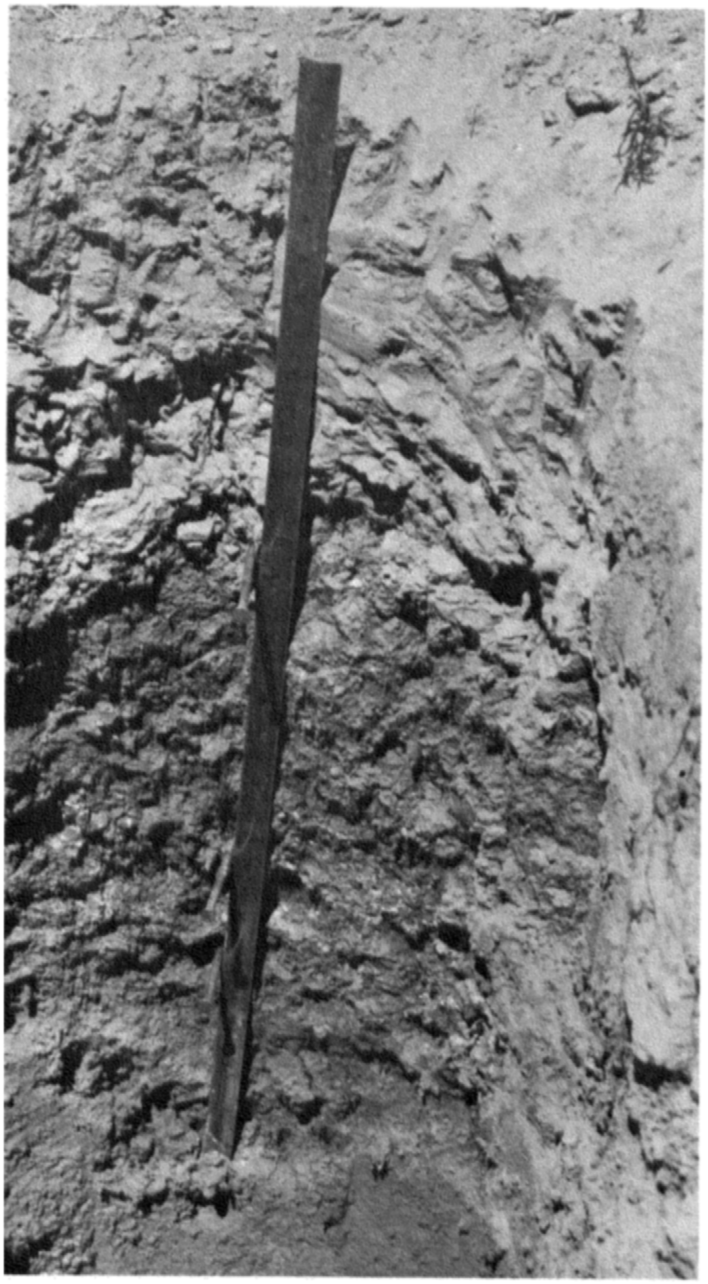

Figure 3.—**Profile of Dalhart loamy sand, 0 to 1 percent slopes.**

and free of lime. The subsoil, about 30 inches thick, is sandy clay loam and sandy loam. The middle part commonly contains the most clay. The subsoil is dark brown in the upper part, but becomes lighter in the lower part. Most of the subsoil is noncalcareous, but the lower few inches is weakly calcareous. Below a depth of about 38 inches is pale-brown, very strongly calcareous loamy sand.

Dalhart soils are well drained and moderately permeable. They absorb water well and have a moderate to high available water capacity and relatively high fertility.

About 50 percent of the acreage is cultivated. Winter wheat, sorghum, and broomcorn are the main crops on both dryland and irrigated areas. In areas used as range, little bluestem, sand bluestem, and side-oats grama are common grasses.

Typical profile of Dalhart loamy sand (210 feet west and 500 feet north of SE. corner, sec. 22, T. 34 S., R. 44 W.):

A1—0 to 8 inches, dark-brown (10YR 4/3) loamy sand, dark brown (10YR 3/3) when moist; single grain; loose when dry, very friable when moist; noncalcareous, pH approximately 7.6; clear, smooth boundary.

B1—8 to 16 inches, dark-brown (7.5YR 4/4) light sandy clay loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure that parts to weak, medium, subangular blocky; slightly hard when dry, friable when moist; thin, patchy clay skins; noncalcareous, pH 7.8; clear, wavy boundary.

B2t—16 to 30 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard when dry, firm when moist; thin, continuous clay skins; noncalcareous, pH 7.8; clear, smooth boundary.

B3—30 to 38 inches, yellowish-brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse, prismatic structure; slightly hard when dry, friable when moist; weakly calcareous, pH 7.9; clear, smooth boundary.

Cca—38 to 60 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; scattered limy spots; very strongly calcareous, pH 7.9.

The A1 horizon ranges from 4 to 12 inches in thickness and from loamy sand to sandy loam in texture. In places this soil overlies a buried soil. The calcareous material is 15 to 38 inches below the surface. The Cca horizon ranges from sand to clay loam.

Dalhart loamy sand, 0 to 1 percent slopes (DaA).—This soil occurs mostly in the southern half of the county.

Included in mapping were small areas of Manter and Vona sandy loams.

The surface runoff on this soil is very slow, and water intake is rapid. Because the subsoil is sandy clay loam, the available water capacity is moderate. Soil blowing is more of a hazard on this soil than it is on Dalhart sandy loams.

About 40 percent of the acreage is cultivated. Broomcorn and sorghum are the main crops. Irrigated crops need fertilizer. A cover crop is necessary every year. Use of crop residue helps prevent soil blowing. On range, deferment and rotation of grazing help protect the sand from blowing. (Capability unit IIIe-3, irrigated, and capability unit IVe-4, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Dalhart loamy sand, 1 to 3 percent slopes (DaB).—This soil occurs mostly in the southern half of the county. The surface layer, about 7 inches thick, is dark-brown loamy sand. The subsoil is sandy clay loam about 14 inches thick. In some places, a buried soil underlies this soil at a depth of 40 to 60 inches.

Included in mapping were small areas of Dalhart, Manter, and Vona sandy loams.

This soil takes in water at a rapid rate and has moderate available water capacity. Because the surface layer is loose loamy sand, soil blowing is the most serious hazard.

About 70 percent of the acreage is cultivated. Broomcorn, grain sorghum, and wheat are the main crops. A cover crop or crop residue is necessary to help prevent soil blowing. Good fertilizing practices help to estab-

lish proper cover, as does stubble mulching, but at harvest time care must be taken to leave a high enough stubble to insure cover. On range, enough vegetation must be left to serve as a cover crop. (Capability unit IIIe-3, irrigated, and capability unit IVe-4, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Dalhart sandy loam, 0 to 1 percent slopes (DhA).—This soil occurs as large, uniformly shaped areas in all but the northeastern quarter of the county. The surface layer, about 6 inches thick, is dark-brown sandy loam. The subsoil is dark-brown sandy clay loam about 14 inches thick. Depth to lime is about 20 inches, and in some places, a buried soil underlies this soil below a depth of 40 inches.

Included in mapping were small areas of Dalhart loamy sand, Manter and Vona sandy loams, and on the eastern boundary of the county, small areas of Richfield silt loam.

This soil takes in water rapidly and has a high available water capacity. Soil blowing is a severe hazard.

About 80 percent of the acreage is cultivated. Broomcorn, sorghum, and winter wheat are the main crops. A cover crop or crop residue is necessary to help prevent soil blowing. Proper water management and good fertilizing practices help to establish proper cover, as does stubble mulching, but at harvest time care must be taken to leave a stubble cover high enough to protect the soil. During periods of drought, emergency tillage practices, such as deep listing, help control soil blowing. Deep listing and stubble mulching help control soil blowing on dryland. On range, proper grazing practices help maintain cover and control soil blowing. (Capability unit I-2, irrigated, and capability unit IIIe-4, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Dalhart sandy loam, 1 to 3 percent slopes (DhB).—This soil occurs in nearly all parts of the county. The surface layer, about 6 inches thick, is dark-brown sandy loam. The subsoil is dark-brown sandy clay loam about 14 inches thick. Depth to lime is about 20 inches, and in some places a buried soil underlies this soil at a depth of 36 to 90 inches.

Included in mapping were small areas of Dalhart loamy sand, Manter and Vona sandy loams, and on the eastern edge of the county, small areas of Ulysses and Norka silt loams.

This soil has high available water capacity. Soil blowing is a hazard, but not so severe as it is on the Dalhart loamy sands. Because of the slope, this soil tends to wash down during heavy thundershowers.

About 70 percent of the acreage is cultivated. Broomcorn, sorghum, and wheat are the main crops. A cover crop or crop residue is necessary to help prevent soil blowing, but because of the slope, it is difficult to grow and maintain adequate cover. Land leveling and good fertilizing practices help to establish cover that produces more crop residue. On nonirrigated land, deep listing, stubble mulching, and contour stripcropping help control erosion. (Capability unit IIe-2, irrigated, and capability unit IIIe-4, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Dune Land

Dune land (Du) is in the southeast corner of the county along the Cimarron River. It is associated with Tivoli soils.

Dune land consists of active sand dunes having little or no vegetation. The sand is generally deep, but eroded pockets are blown down to heavier material.

Permeability is very rapid, and there is no runoff. Fertility and available water capacity are low.

This land has no value for grazing and is a hazard to the surrounding area because of the blowing sand. Vegetation should be established on this land. Fencing helps in establishing vegetation, and in revegetated areas, grazing should be deferred or prevented. (Capability unit VIIIe-1, nonirrigated; too unstable for range site classification; not suitable as a site for windbreaks)

Glenberg Series

The Glenberg series consists of deep, nearly level, light-colored sandy loams on low terraces and flood plains.

In a typical profile the surface layer, about 5 inches thick, is pale-brown sandy loam that is strongly calcareous. The next layer is pale-brown, strongly calcareous sandy loam, about 10 inches thick, that contains thin strata of loamy sand and loam in places. The underlying material is pale-brown stratified alluvium. Texture of the strata ranges from clay loam to sand, but is mainly sandy loam.

Glenberg soils are somewhat excessively drained and rapidly permeable. They take in water rapidly, but have only a moderate available water capacity.

About 30 percent of the acreage is cultivated. Wheat and sorghum are the main crops. In areas used as range, the vegetation is mainly sand sage, Indian ricegrass, and switchgrass.

Typical profile of Glenberg sandy loam (1,848 feet south and 200 feet west of NE. corner, sec. 4, T. 28 S., R. 45 W.):

A1—0 to 5 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; loose when dry, very friable when moist; strongly calcareous; clear, smooth boundary.

AC—5 to 15 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; soft when dry, very friable when moist; thin strata of loamy sand; strongly calcareous; clear, smooth boundary.

C—15 to 60 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; strongly stratified with thin lenses of clay loam, sandy loam, loamy sand, and sand in the lower portion; strongly calcareous; clear, smooth boundary.

The A horizon ranges from 3 to 8 inches in thickness and from sandy loam to sand in texture. In places, a layer of loam 1 to 2 inches thick occurs on the surface. The C horizon contains lenses of loam, and in places, lenses of clay loam that are stratified with sand and loamy sand.

Glenberg sandy loam (0 to 1 percent slopes) (Gb).—This soil occupies edges of drainageways throughout the county.

Included in mapping were small areas of Bankard sand and McCook loam.

This soil has slow surface runoff and rapid internal drainage. Soil blowing is a severe hazard.

About 30 percent of this acreage is cultivated. Wheat and grain sorghum are the major crops in both dryland and irrigated areas. Fertilizing, use of crop residue, and water management are necessary for controlling soil blowing. In areas that are dryfarmed, stubble mulching and stripcropping are necessary. (Capability unit IIs-2, irrigated, and capability unit IVe-3, nonirrigated; Sandy Bottomland range site; Sandy windbreak suitability group)

Goshen Series

The Goshen series consists of deep, dark-colored, level and nearly level loams that are in swales of the loessial uplands.

In a typical profile the surface layer, about 10 inches thick, is grayish-brown loam. It is free of lime. The subsoil, about 20 inches thick, is dark grayish-brown silty clay loam that is free of lime in the upper part, but in places, has lime in the lower part. The underlying material is brown silty clay loam.

Goshen soils are well drained. They have moderate permeability, a high available water capacity, and high natural fertility. They are susceptible to gullying.

Most of the acreage is cultivated. Wheat and sorghum are the main crops. Where in native range, blue grama and buffalograss are the principal grasses.

Typical profile of Goshen loam (225 feet west and 592 feet north of SE. corner, sec. 26, T. 28 S., R. 42 W.):

Ap—0 to 4 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; noncalcareous, pH 7.7; clear, smooth boundary.

A1—4 to 10 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; noncalcareous, pH 7.6; clear, smooth boundary.

B2t—10 to 30 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; noncalcareous, pH 8.0; clear, smooth boundary.

C—30 to 48 inches, brown (10YR 5/3) silty clay loam, dark yellowish brown (10YR 4/4) when moist; massive; hard when dry, firm when moist; strongly calcareous, pH 8.0; clear, smooth boundary.

The A horizon ranges from 4 to 12 inches in thickness and from loam to clay loam in texture (fig. 4). The B2t horizon ranges from 10 to 30 inches in thickness and from heavy loam to silty clay loam in texture. In some places, the B2t horizon is underlain by a buried soil.

Goshen loam, 0 to 1 percent slopes (GoA).—This soil occurs as concave areas mainly in the northeastern quarter of the county. The surface layer ranges from loam to clay loam in texture and from 4 to 12 inches in thickness. The clay loam subsoil is about 10 inches thick. Lime occurs at a depth of 20 to 30 inches, and in some places, a buried soil is present.

Included in mapping were small areas of Baca clay loam and Wiley loam, and on the eastern boundary of the county, small areas of Richfield and Ulysses and Norka silt loams.

This soil takes in water at a moderate rate and has medium surface runoff.

Most of the acreage is cultivated. Winter wheat and sorghum are the main crops. Proper water management is necessary, and during periods of drought, deep listing and chiseling are helpful. Where the soil is dryfarmed, stubble mulching and stripcropping help control soil blowing. On range, deferred grazing is needed. (Capability unit I-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Figure 4.—Profile of Goshen loam, 0 to 1 percent slopes, a deep, well-drained soil.

Goshen loam, 1 to 3 percent slopes (GoB).—This soil occurs as small areas on the side slopes of drainageways in the northeastern quarter of the county. The surface layer is loam or light clay loam about 4 to 12 inches thick. The subsoil, about 14 inches thick, is silt loam or clay loam. Lime occurs at a depth of 15 to 30 inches.

Included in mapping were small areas of Wiley loam and Baca clay loam.

This soil has moderate water intake. Surface runoff is medium.

Most of the acreage is cultivated. Wheat and sorghum are the main crops. Land leveling is necessary for uniform application of water. During periods of drought, deep listing and chiseling are needed. Stubble mulching and stripcropping help control soil blowing. On range, proper management practices such as deferred and rotation grazing are necessary for maintaining and improving the vegetative cover. (Capability unit IIe-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Gravelly Land

Gravelly land (3 to 20 percent slopes) (Gr) borders the major drainageways. It consists of excessively drained, relatively thin, gently sloping to moderately steep soils on uplands.

The surface layer of this land type is light-colored gravelly loam in most places, but small areas of sandy loam are common. The subsoil ranges from gravelly loam to light clay loam.

Gravelly land has moderately rapid to rapid surface runoff, moderate permeability, and low available water capacity.

All of the acreage is in native vegetation that consists mainly of side-oats grama, blue grama, buffalograss, and yucca. (Capability unit VIIs-2, nonirrigated; Gravel Breaks range site)

Harbord Series

The Harbord series consists of deep, nearly level to gently sloping, light-colored loams on uplands.

In a typical profile the surface layer, about 3 inches thick, is brown, very strongly calcareous loam. The subsoil is brown, noncalcareous silty clay loam about 13 inches thick that rests on an older buried soil about 13 inches thick. The buried soil is clay loam and contains many white lime streaks and mottles. Below a depth of about 29 inches is pink, very strongly calcareous clay loam.

Harbord soils are naturally well drained. They have moderate to slow water intake, high available water capacity, and high natural fertility.

Most of the acreage is cultivated. Wheat and sorghum are the main crops. Much of the acreage is dryfarmed, but some of it is irrigated. Where in native grass, blue grama and buffalograss are the principal grasses.

Typical profile of Harbord loam (1,584 feet south and 110 feet west of NE. corner, sec. 4, T. 29 S., R. 42 W.):

Ap—0 to 3 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 4/3) when moist; moderate, fine, granular structure; hard when dry, firm when moist; very strongly calcareous; clear, smooth boundary.

B21t—3 to 16 inches, brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky; hard when dry, very firm when moist; thin, patchy clay skins; noncalcalcareous; gradual, wavy boundary.

B22cab—16 to 29 inches, light-brown (7.5YR 6/4) clay loam, dark brown (7.5YR 4/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard when dry, firm when moist; thin, patchy clay skins; very strongly calcareous; gradual, wavy boundary,

Cca—29 to 60 inches, pink (7.5YR 8/4) clay loam, pink (7.5YR 7/4) when moist; massive; slightly hard when dry, firm when moist; very strongly calcareous.

The A horizon ranges from 2 to 6 inches in thickness and from loam to light clay loam in texture. The B2t horizon ranges from 6 to 20 inches in thickness and from silty clay loam to clay loam in texture. Depth to the buried soil ranges from 10 to 20 inches.

Harbord loam, 0 to 1 percent slopes (HaA).—This soil occurs throughout the county.

Included in mapping were small areas of Baca and Campo clay loam; small areas of Potter gravelly loam in the western half of the county; and, near Walsh, areas of Wiley loam.

This soil absorbs water well. Surface runoff is slow, and available water capacity is high. Soil blowing is the major hazard.

About 70 percent of the acreage is cultivated. Wheat and sorghum are the main crops. Fertilizing, use of crop residue, and water management are necessary to improve production. Stubble mulching and stripcropping help control soil blowing, and during periods of drought, deep listing and chiseling also help. Proper range management is necessary. (Capability unit I-1, irrigated, and capability unit IVe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Harbord loam, 1 to 3 percent slopes (HaB).—This soil occurs throughout the county.

Included in mapping were small areas of Baca clay loam and Harvey loam.

This soil has medium surface runoff.

About 70 percent of the acreage is cultivated. Winter wheat and sorghum are the main crops in both dryland and irrigated areas. Land leveling, fertilizing, use of crop residue, and water management are necessary to improve production. Stubble mulching and stripcropping help control soil blowing, and during periods of drought, deep listing and chiseling also help. Proper range management is necessary. (Capability unit IIe-1, irrigated, and capability unit IVe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Harbord loam, 3 to 5 percent slopes (HaC).—This soil occurs throughout the county. It has a profile similar to that described as typical for the series except that in many places the soil surface is moderately eroded.

Included in mapping were small areas of Wiley and Harvey loams, Baca clay loam, and Colby silt loam.

Where there is adequate cover, runoff is medium. Where cover is inadequate, runoff is rapid. Internal drainage is slow.

Nearly all of the acreage is in native vegetation. Blue grama and buffalograss are the most common grasses. Small areas are cultivated. Because of the slope of the soil, good management practices are important for preventing erosion. Stubble mulching and stripcropping are necessary. During periods of drought, deep listing and chiseling help control erosion. On range, proper management is necessary. (Capability unit IIIe-2, irrigated, and capability unit IVe-2, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Harvey Series

The Harvey series consists of deep, gently sloping, light-colored loams.

In a typical profile the surface layer, about 6 inches thick, is light brownish-gray loam. In some places, gravel is present on the surface. The transitional layer is very limy pale-brown loam about 8 inches thick. The underlying material is a very limy, very pale brown sandy clay loam that grades to a sandy loam with depth.

Harvey soils are generally well drained. Internal drainage is medium, and available water capacity is high.

Most of the acreage is in native range. Buffalograss and blue grama are the main grasses.

Typical profile of Harvey loam (40 feet north and 1,056 feet west of SE. corner, sec. 25, T. 29 S., R. 43 W.):

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard when dry, friable when moist; few scattered gravels; very strongly calcareous, pH 7.8; clear, smooth boundary.

AC—6 to 14 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, firm when moist; scattered gravels; very strongly calcareous, pH 7.8; clear, smooth boundary.

C1ca—14 to 28 inches, very pale brown (10YR 7/3) sandy clay loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, firm when moist; many lime spots and scattered gravels; very strongly calcareous, pH 7.9; clear, smooth boundary.

C2ca—28 to 60 inches, very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; sand and gravel mixed; very strongly calcareous, pH 8.1.

The A horizon ranges from 2 to 7 inches in thickness. The amount of gravel on the surface and in the profile ranges from 2 to 10 percent. The Cca horizon is 15 to 40 percent calcium carbonate. In some places, loamy sand or sand is below a depth of 36 inches.

Harvey loam, 1 to 5 percent slopes (HrC).—This soil occurs in nearly all parts of the county.

Included in mapping were small areas of Colby silt loam and Harbord loam.

This soil has medium to rapid surface runoff and moderate permeability. The hazard of soil blowing is very high where this soil is cultivated.

Only about 10 percent of the acreage is cultivated. Wheat and sorghum are the main crops. On range, blue grama, side-oats grama, and buffalograss are the main grasses. Cropped areas should be reseeded to grass. (Capability unit VIe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Kim Series

The Kim series consists of deep, light-colored, nearly level to moderately sloping loams on foot slopes and fans below sandstone bluffs and breaks.

In a typical profile the surface layer, about 9 inches thick, is strongly calcareous, grayish-brown loam. The transitional layer is grayish-brown, strongly calcareous clay loam about 8 inches thick. The upper part of this layer generally is darker than the lower part and contains more clay. The underlying material is brown, strongly calcareous clay loam that has many white lime spots.

Kim soils are well drained and moderately permeable. They have rapid surface runoff and high available water capacity.

Most of the acreage is in native range. Blue grama, buffalograss, and side-oats grama are the principal grasses.

Typical profile of Kim loam (820 feet east and 200 feet north of SW. corner, sec. 16, T. 33 S., R. 50 W.):

A1—0 to 9 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; hard when dry, friable when moist; strongly calcareous; gradual, smooth boundary.

AC—9 to 17 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; strongly calcareous; clear, smooth boundary.

Cca—17 to 60 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; very weak, medium, subangular blocky structure; hard when dry, firm when moist; thin, patchy clay skins; many white lime spots; strongly calcareous.

The A horizon ranges from sandy loam to light clay loam in texture. In some areas it has a little gravel on the surface. The C horizon ranges from loam to clay loam in texture, and it contains up to 5 percent gravel.

Kim loam, 0 to 9 percent slopes (KmD).—This soil occurs in the western part of the county.

Included in mapping were small areas of Travessilla stony sandy loam and Baca clay loam.

Runoff is rapid, and water erosion is the major hazard. A small part of the more gently sloping areas is cultivated, mainly to feed crops. Stubble mulching and contour farming help prevent soil blowing and water erosion. Most of the acreage is in native range. Blue grama, side-oats grama, and snakeweed are common. Proper range management practices, such as deferred grazing, are necessary to prevent gullying. (Capability unit VIe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Manter Series

The Manter series consists of deep, level to nearly level, dark-colored sandy loams that are on uplands mainly in the southern half of the county.

In a typical profile the surface layer, about 2 inches thick, is grayish-brown sandy loam. The subsoil is dark-brown and brown sandy loam about 12 inches thick. It is slightly hard when dry and friable when moist. Below a depth of about 14 inches is very pale brown sandy loam that contains visible lime and is very strongly calcareous.

Manter soils are well drained. Permeability is rapid, internal drainage is medium to rapid, and available water capacity is moderate.

Most of the acreage is cultivated. Wheat, sorghum, and broomcorn are the main crops. In areas of native range, buffalograss and blue grama are the main grasses.

The Manter soils in Baca County are mapped only with Vona soils.

Typical profile of Manter sandy loam (1,010 feet west and 45 feet south of NE. corner, sec. 23, T. 34 S., R. 44 W.):

A1—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist; noncalcareous, pH 7.5; abrupt, smooth boundary.

B2t—2 to 9 inches, dark-brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to weak, medium to fine, subangular blocky; slightly hard when dry, friable when moist; thin, patchy clay skins; noncalcareous, pH 7.4; clear, smooth boundary.

B3—9 to 14 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; noncalcareous, pH 7.4; clear, smooth boundary.

C1ca—14 to 28 inches, very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, firm when moist; very high content of lime; scattered pebbles; very strongly calcareous, pH 7.6; clear, smooth boundary.

C2—28 to 60 inches, very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; sand and gravel mixed; very strongly calcareous, pH 7.6.

The A horizon ranges from 2 to 8 inches in thickness and from loamy sand to sandy loam in texture. The B2t horizon ranges from 5 to 10 inches in thickness. Depth to lime ranges from 6 to 20 inches. The C horizon ranges in texture from sand and loamy sand to loam.

Manter and Vona sandy loams, 0 to 1 percent slopes (MaA).—Areas of this undifferentiated group occur in all parts of the county. About 60 percent of each mapped area is Manter soil and about 30 percent is Vona soil. Included in mapping were small areas of Tivoli sand, in the southeastern part of the county, and areas of Dalhart sandy loam that make up about 10 percent of each mapped area.

The surface layer of the soils in this group is about 4 inches thick. The Manter soil is darker colored than the Vona.

Soil blowing is the major hazard.

About 40 percent of the acreage is cultivated. Wheat, grain sorghum, and broomcorn are the principal crops. Fertilizing, use of crop residue, and frequent, light irrigations are necessary for good crop production. During periods of drought, deep listing is needed. Stubble mulching and stripcropping help control soil blowing. (Capability unit IIs-2, irrigated, and capability unit IVe-3, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Manter and Vona sandy loams, 1 to 3 percent slopes (MaB).—Areas of this undifferentiated group occur in all parts of the county, but primarily in the southern half. About 45 percent of each area is Manter soil and about 45 percent is Vona soil. Included in mapping were small areas of Tivoli sand in the southeastern part of the county and areas of Dalhart sandy loam, which make up about 10 percent of each mapped area.

These soils have slow surface runoff, medium to rapid internal drainage, and moderate available water capacity. Where these soils are more sloping, the surface layer is thinner. Soil blowing is the greatest hazard.

About 40 percent of the acreage is cultivated. Broomcorn, sorghum, and wheat are the main crops in both dryland and irrigated areas. Cover crop or crop residue is necessary at all times to help control soil blowing. In irrigated areas, fertilization, use of crop residue, and water management help control soil blowing. Land leveling is necessary in some places for proper water management. Stubble mulching, contour farming, and stripcropping help control soil blowing. During periods of drought, deep chiseling and listing are necessary. On range, proper management is necessary. (Capability unit IIIe-1, irrigated, and capability unit IVe-3, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Manvel Series

The Manvel series consists of deep, well-drained, light-colored, medium-textured soils that developed from limestone. These soils occur on uplands in the northeastern part of the county.

In a typical profile the surface layer, about 3 inches thick, is pale-brown, very strongly calcareous loam. The transitional layer, about 9 inches thick, is brown, very strongly calcareous silt loam. The underlying material is pale-brown silt loam that contains a few limestone fragments.

Manvel soils are well drained. Permeability is moderate, internal drainage is medium, and available water capacity is high.

Most of the acreage is in native range. The vegetation is mainly buffalograss, galletagrass, snakeweed, and blue grama.

The Manvel soils in Baca County are mapped with Minnequa soils. This mapping unit is described under the heading "Minnequa Series."

Typical profile of Manvel loam (1,040 feet east and 55 feet south of NW. corner, sec. 32, T. 28 S., R. 49 W.):

A1—0 to 3 inches, pale-brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry, friable when moist; few small limestone chips; very strongly calcareous, pH 7.9; abrupt, smooth boundary.

AC—3 to 12 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; very weak, coarse, prismatic structure that parts to very weak, medium, subangular blocky; slightly hard when dry, friable when moist; very strongly calcareous, pH 7.9; clear, smooth boundary.

C—12 to 60 inches, pale-brown (10YR 6/3) silt loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, friable when moist; few limestone chips; very strongly calcareous, pH 7.8.

The A horizon ranges from 2 to 6 inches in thickness and from loam to silt loam in texture. The texture of the C horizon ranges from silt loam to loam. Content of lime is high throughout the profile. The structure ranges from massive to blocky.

McCook Series

The McCook series consists of deep, nearly level, dark-colored loams on terraces in the western part of the county (fig. 5).

In a typical profile the surface layer is grayish-brown, weakly calcareous loam about 8 inches thick. The transitional layer, about 9 inches thick, is grayish-brown, strongly calcareous loam. The underlying material is grayish-brown and pale-brown loam that is very strongly calcareous.

McCook soils are well drained. They have moderate permeability and high available water capacity.

Most of the acreage is cultivated. Wheat, sorghum, and alfalfa are the main crops. In areas of native range, blue grama and buffalograss are the major grasses.

Typical profile of McCook loam (90 feet north and 1,056 feet east of the irrigation well in NE. 1/4 corner, sec. 2, T. 35 S., R. 50 W.):

Ap—0 to 8 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; slightly hard when dry, friable when moist; weakly calcareous, pH 7.8; clear, smooth boundary.

AC—8 to 17 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium to coarse, subangular blocky structure; slightly hard when dry, friable when moist; strongly calcareous, pH 7.8; clear, smooth boundary.

C1—17 to 25 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard when dry, firm when moist; very strongly calcareous, pH 7.9; clear, smooth boundary.

C2—25 to 46 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) when moist; massive; hard when dry, firm when moist; very strongly calcareous, pH 8.0; clear, smooth boundary.

C3—46 to 60 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard when dry, friable when moist; very strongly calcareous, pH 7.9.

The A horizon ranges in texture from loam to clay loam. In some places a buried soil is present at a depth of 3 to 5 feet. The depth to lime ranges from 0 to 5 inches.

McCook loam, 0 to 1 percent slopes (McA).—This soil occupies small, low terraces along the major drainageways.

Included in mapping were small areas of McCook loam, 1 to 3 percent slopes, Nunn clay loam, and Wages loam.

This soil has slow surface runoff and moderate permeability.

About 50 percent of the acreage is cultivated. Wheat, sorghum, and alfalfa are the main crops. Timely, adequate irrigation helps to produce high crop yields. Where this soil is dryfarmed, stubble mulching and stripcropping help reduce soil blowing. (Capability unit I-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

McCook loam, 1 to 3 percent slopes (McB).—This soil occupies low terraces along major drainageways.

Included in mapping were small areas of Nunn clay loam, Wages loam, and in the southwestern corner of the county, small areas of Kim loam.

This soil has medium surface runoff and moderate permeability.

About 60 percent of the acreage is cultivated. In the southwestern quarter of the county, feed sorghum and alfalfa are the main crops, and in the rest of the county, small areas are planted to wheat and sorghum. In irrigated areas, careful water management is important and land leveling is essential. In dryfarmed areas, stubble mulching helps prevent soil blowing. (Capability unit

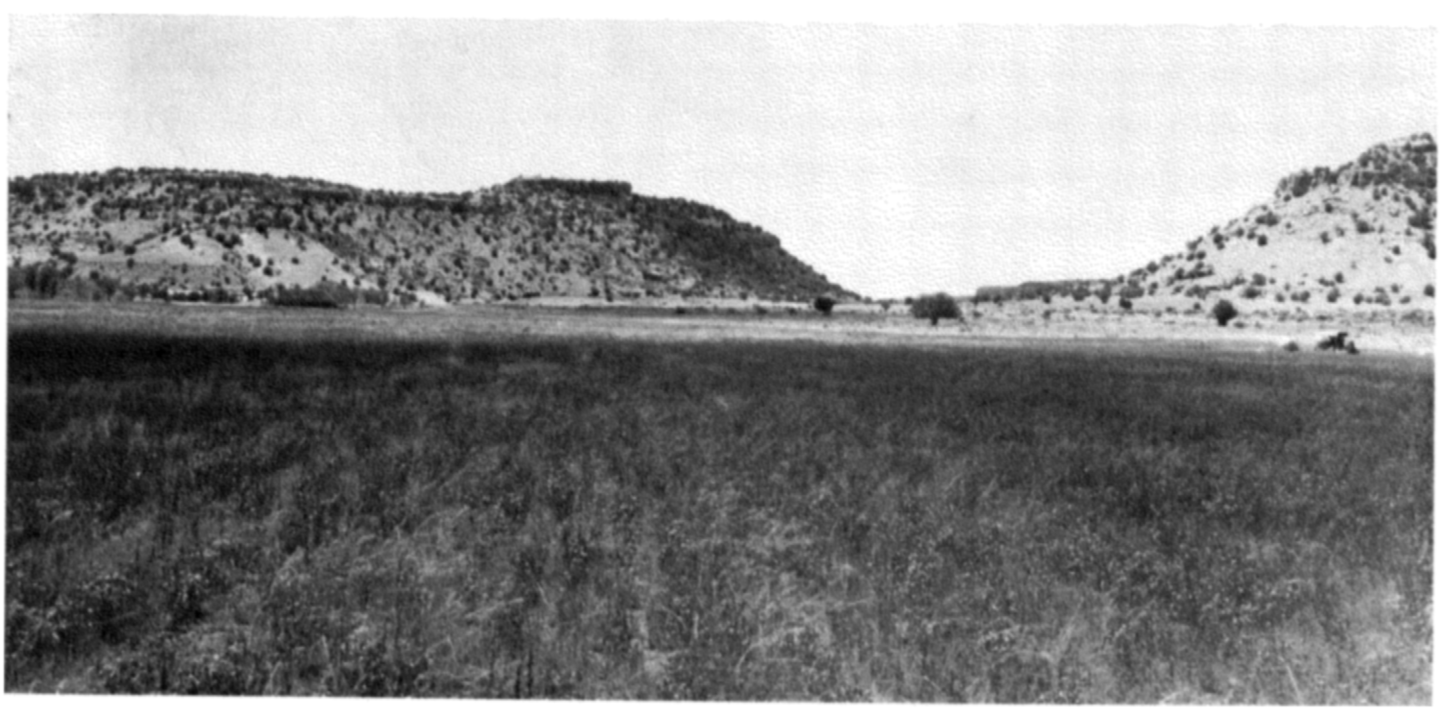

Figure 5.—Nearly level soil in foreground is McCook loam, 0 to 1 percent slopes.

IIe-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Minnequa Series

The Minnequa series consists of moderately deep, light-colored, medium-textured soils over limestone or marl.

In a typical profile the surface layer, about 9 inches thick, is light brownish-gray loam that is very strongly calcareous. The underlying material, about 21 inches thick, is a friable, very pale brown and pale-brown loam that is strongly calcareous and contains many small fragments of limestone. Below this is limestone.

Minnequa soils are well drained. Surface runoff is medium to rapid, and available water capacity is moderate.

Most of the acreage is in native range. The vegetation is mainly buffalograss, galletagrass, snakeweed, and blue grama.

The Minnequa soils in Baca County are mapped with Manvel soils.

Typical profile of Minnequa loam (145 feet east and 1,848 feet south of NW. corner, sec. 6, T. 29 S., R. 48 W.):

A1—0 to 9 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, medium to fine, granular structure; slightly hard when dry, friable when moist; many limestone chips; very strongly calcareous; abrupt, smooth boundary.

C1—9 to 15 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; many limestone chips; very strongly calcareous; clear, smooth boundary.

C2—15 to 30 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; many limestone chips; very strongly calcareous; clear, smooth boundary.

R—30 to 60 inches, partly weathered limestone; stratified with thin lenses of limy shale.

Minnequa soils range from 20 to 40 inches in depth to underlying limestone. The content of limestone ranges from 5 to 10 percent.

Minnequa-Manvel complex (1 to 9 percent slopes) (Mm).—This complex occurs in the northwestern corner of Baca County. About 40 percent of each mapped area is Minnequa soil and about 35 percent is Manvel soil. Included in mapping were areas of shallow Penrose soils, which occur as knobs and breaks in the topography and make up about 15 percent of each mapped area, and areas of Colby, Wiley, and Harbord soils, which make up about 10 percent of each mapped area.

These soils have medium to rapid surface runoff and moderate permeability.

This acreage is not suited to dryfarming. Although wheat and sorghum are grown in small areas, most of the acreage is in grass, primarily blue grama and buffalograss. (Capability unit VIe-1, nonirrigated; Loamy Plains range site)

Norka Series

The Norka series consists of deep, dark-colored, nearly level to level silt loams on uplands.

In a typical profile the surface layer, about 4 inches thick, is grayish-brown silt loam that is free of lime. The subsoil is dark grayish-brown and grayish-brown silty clay loam about 11 inches thick. It is free of lime in the upper part. The underlying material is brown silt loam.

Norka soils are naturally well drained. Internal drainage is medium, and available water capacity is high.

Most of the acreage is cultivated. Wheat and sorghum are the main crops in both dryfarmed and irrigated areas. If irrigated, sugar beets can also be grown. In areas used as range, blue grama and buffalograss are the major grasses.

The Norka soils in Baca County are mapped with Ulysses soils. These mapping units are described under the heading "Ulysses Series."

Typical profile of Norka silt loam (90 feet west and 1,056 feet north of SE. corner, sec. 26, T. 29 S., R. 42 W.):

Ap—0 to 4 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; hard when dry, very friable when moist; noncalcareous, pH 8.0; clear, smooth boundary.

B2t—4 to 10 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, prismatic structure that parts to weak to moderate, fine, subangular blocky; hard when dry, friable when moist; thin, patchy clay skins; noncalcareous, pH 8.0; clear, smooth boundary.

B3—10 to 15 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist; strongly calcareous, pH 7.9; clear, smooth boundary.

Cca—15 to 60 inches, brown (10YR 5/3) silt loam, dark brown (10YR 4/3) when moist; massive; slightly hard when dry, very friable when moist; about 10 percent lime spots; very strongly calcareous, pH approximately 7.8.

The A horizon ranges from 3 to 7 inches in thickness and from silt loam to light clay loam in texture. The B horizon ranges from 8 to 15 inches in thickness.

Nunn Series

The Nunn series consists of deep, nearly level, dark-colored clay loams on terraces in the southwestern part of the county.

In a typical profile the surface layer is lime-free, grayish-brown clay loam about 6 inches thick. The subsoil, about 23 inches thick, is dark grayish-brown and grayish-brown clay loam that contains lime in the lowest few inches. The underlying material is light brownish-gray and very pale brown clay loam that is high in lime content and contains many lime concretions.

Nunn soils are well drained and slowly permeable. Internal drainage is slow, surface runoff is medium, and available water capacity is high.

Nearly all of the acreage is in native range. Blue grama and buffalograss are the main grasses.

Typical profile of Nunn clay loam (750 feet north and 500 feet west of SE. corner, sec. 10, T. 35 S., R. 50 W.):

A1—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; slightly hard when dry, friable when moist; noncalcareous; clear, smooth boundary.

B2t—6 to 20 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard when dry, firm when moist; thin, patchy clay skins; noncalcareous; gradual, smooth boundary.

B3ca—20 to 29 inches, grayish-brown (10YR 5/2) clay loam, dark brown (10YR 4/3) when moist; moderate, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky; very hard when dry, firm when moist; few patchy clay skins; few small lime spots and streaks; strongly calcareous; clear, smooth boundary.

C1ca—29 to 38 inches, light brownish-gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) when moist; moderate, fine, angular and subangular blocky structure; very hard when dry, friable when moist; many lime spots; very strongly calcareous; gradual, smooth boundary.

C2ca—38 to 60 inches, very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) when moist; massive; hard when dry, friable when moist; very strongly calcareous.

The A horizon ranges from 4 to 8 inches in thickness and from heavy loam to clay loam in texture. The B2t horizon ranges from clay loam to clay in texture. In some places, the C horizon contains 10 to 15 percent gravel.

Nunn clay loam (0 to 3 percent slopes) (Nu).—This soil occurs in the southwestern part of the county.

Included in mapping were small areas of McCook and Wages loams.

This soil has slow internal drainage, medium surface runoff, and high available water capacity.

Most of the acreage is in native range. The vegetation is mainly blue grama, buffalograss, and cane cactus. In irrigated areas, careful water management is essential, and land leveling and fertilization are beneficial. On range, proper management practices, such as deferred and rotation grazing, are necessary for controlling soil blowing and water erosion. (Capability unit IIs-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Otero Series

The Otero series consists of deep, nearly level to undulating and rolling, light-colored, moderately sandy soils.

In a typical profile the surface layer, about 13 inches thick, is light brownish-gray sandy loam. The next layer is very pale brown sandy loam about 17 inches thick. It contains lime, part of which occurs as white concretions. Below a depth of 30 inches is very pale brown, limy sandy loam that is stratified with lenses of loamy sand.

Otero soils are somewhat excessively drained, and they absorb moisture rapidly. Surface runoff is slow, and available water capacity and natural fertility are moderate. These soils are very susceptible to soil blowing.

Some of the acreage is cultivated. Broomcorn and sorghum are the main crops. Because the hazard of soil blowing is high, a continuous plant cover is necessary to protect the soil. In areas of native range, the vegetation is mainly sand sage, yucca, little bluestem, and sand dropseed.

Typical profile of Otero sandy loam (1,850 feet west and 250 feet north of SE. corner, sec. 6, T. 31 S., R. 50 W.):

A1—0 to 5 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, granular structure; soft when dry, very friable when moist; weakly calcareous, pH 7.2; clear, smooth boundary.

AC—5 to 13 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) when moist; very weak, medium, subangular blocky structure; soft when dry, very friable when moist; strongly calcareous, pH 7.5; gradual, smooth boundary.

C1ca—13 to 30 inches, very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) when moist; massive; slightly hard when dry, very friable when moist; lime concretions; very strongly calcareous, pH 7.8; clear, smooth boundary.

C2—30 to 60 inches, very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) when moist; single grain; soft when dry, very friable when moist; thin lenses of loamy sand; few lime concretions; very strongly calcareous, pH 8.0.

The A horizon ranges in texture from loamy sand to sandy loam. Below a depth of 30 inches the texture of the C horizon ranges from loam to loamy sand.

Otero sandy loam, 0 to 3 percent slopes (OeB).—This soil occurs in the southern and western parts of the county. Included in mapping were small areas of Manter and Vona sandy loams, and in the southeastern part of the county, small areas of Tivoli sand.

The surface runoff on this soil is slow, and permeability is rapid. Where the soil is cultivated, the hazard of soil blowing is high.

Although this soil is best suited to native vegetation, such as side-oats grama, sand sage, and blue grama, about 40 percent of the acreage is cultivated. Broomcorn and sorghum are the main crops. Small areas are irrigated. Stubble mulching and stripcropping help control soil blowing. On pasture and range, proper management practices, such as deferred and rotation grazing, are necessary. (Capability unit IIIe-1, irrigated, and capability unit IVe-3, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Otero sandy loam, 3 to 9 percent slopes (OeD).—This gently sloping to strongly sloping soil occurs on uplands in the southern and western parts of the county.

Included in mapping were small areas of Harvey loam in the western part of the county, and small areas of Tivoli sand and Vona sandy loam in the southern part of the county.

Nearly all of the acreage is in native vegetation. Side-oats grama, blue grama, and sand sage are common. Proper range management, such as deferred and rotation grazing, is necessary. (Capability unit VIe-3, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Otero-Potter complex (1 to 9 percent slopes) (Op).—This complex occurs in the southeastern quarter of the county. About 50 percent of each area is Otero sandy loam and about 20 percent is Potter gravelly loam. Included in mapping were Manter and Vona sandy loams that make up about 20 percent of each mapped area, and Tivoli sand that makes up about 10 percent of each mapped area.

The slopes range from undulating to rolling, but are mostly 3 or 4 percent. Surface runoff is slow, and permeability is rapid.

This acreage is unsuited for cultivation. On range, the vegetation is mainly blue grama, sand sage, yucca, sand dropseed, and sand lovegrass. A protective cover is necessary at all times to control erosion. Deferred grazing helps maintain the vegetation. (Both soils in capability

unit VIe-3, nonirrigated; Otero soil in Sandy Plains range site and in Sandy windbreak suitability group; Potter soil in Gravel Breaks range site)

Penrose Series

The Penrose series consists of gently sloping to moderately steep, medium-textured soils that are shallow over limestone. They occur in the northwestern part of the county.

In a typical profile the surface layer is pale-brown channery loam about 2 inches thick. The transitional layer, about 7 inches thick, is light brownish-gray channery loam. Below this is limestone.

Penrose soils are well drained. They absorb water well, but have a low available water capacity. Surface runoff is rapid on the steeper slopes and medium on the more gentle slopes.

All of the acreage is in native range. The vegetation is mainly snakeweed, buffalograss, and blue grama.

Typical profile of Penrose channery loam (500 feet north of SW. corner, sec. 31, T. 28 S., R. 48 W.):

A1—0 to 2 inches, pale-brown (10YR 6/3) channery loam, brown (10YR 5/3) when moist; weak, fine, platy structure that parts to moderate, fine, granular; soft when dry, very friable when moist; few limestone chips; strongly calcareous, pH 7.8; clear, smooth boundary.

AC—2 to 9 inches, light brownish-gray (10YR 6/2) channery loam, grayish brown (10YR 5/2) when moist; very weak, medium, subangular blocky to massive structure; slightly hard when dry, very friable when moist; many limestone chips; very strongly calcareous, pH 8.0; clear, smooth boundary.

R—9 inches +, limestone bedrock, partially fractured and weathered.

These soils range in depth to limestone from 6 to 18 inches.

Penrose channery loam (2 to 9 percent slopes) (Pe).—This soil occurs as relatively small areas in the northwestern part of the county.

Included in mapping were small areas of Minnequa, Manvel, and Thedalund soils, and many outcrops of limestone and shale.

These soils have rapid runoff on the steeper slopes and medium runoff on more gentle slopes. They absorb water well, but have low available water capacity.

Most of the acreage is in native range. The vegetation is mainly blue grama, buffalograss, and snakeweed. The only areas that are cultivated are small patches in the middle of large fields that would be difficult to farm around. On range, proper management practices are necessary to control soil blowing and water erosion. (Capability unit VIIs-3, nonirrigated; Limestone Breaks range site)

Potter Series

The Potter series consists of shallow, gently sloping to undulating, light-colored gravelly loams. They are underlain by caliche and occur in all parts of the county.

In a typical profile the surface layer, about 8 inches thick, is grayish-brown gravelly loam. It is underlain by caliche.

Potter soils absorb water well, but because they are shallow, available water capacity is low. Runoff is medium. These soils are susceptible to soil blowing and water erosion.

Although the acreage is not suited to cultivation, a few small areas within fields of other soils are cultivated. Most of the acreage is in native range. Blue grama and buffalograss are the major grasses.

Typical profile of Potter gravelly loam (1,584 feet east and 520 feet north of SW. corner, sec. 34, T. 30 S., R. 43 W.):

A1—0 to 2 inches, grayish-brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; very weak to weak, fine, platy structure; soft when dry, friable when moist; small limestone fragments; very strongly calcareous, pH 7.8; clear, smooth boundary.

AC—2 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; very weak to weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; plentiful lime-covered gravel; very strongly calcareous, pH 8.0; clear, smooth boundary.

R—8 inches, caliche bedrock.

The texture ranges from loam to gravelly loam. Depth to bedrock ranges from 6 to 20 inches.

Potter gravelly loam (1 to 9 percent slopes) (Po).—This soil occurs throughout the county.

Included in mapping were small areas of Harvey and Harbord loams.

This soil absorbs water well, but because of the shallow depth to limestone, available water capacity is low. Surface runoff is medium, and this soil is susceptible to soil blowing and water erosion.

Nearly all of the acreage is in native range. The only areas that are cultivated are small patches in the middle of large fields that would be difficult to farm around. On range, proper management practices, such as deferred grazing, are necessary to prevent erosion. (Capability unit VIIs-2, nonirrigated; Gravel Breaks range site)

Richfield Series

The Richfield series consists of deep, nearly level, dark-colored silt loams that are on loess-mantled uplands along the eastern edge of the county.

In a typical profile the surface layer, about 5 inches thick, is grayish-brown silt loam. The subsoil, about 18 inches thick, is a grayish-brown silty clay loam that becomes light brownish gray in the lower part. Below a depth of about 23 inches is a pale-brown silt loam that contains many white lime spots and is very strongly calcareous.

Richfield soils are well drained and have moderate permeability. Available water capacity is high.

Most of the acreage is cultivated. Winter wheat, small grains, and sorghum are the major crops. In areas of native range, buffalograss and blue grama are the main grasses.

Typical profile of Richfield silt loam (195 feet west and 2,110 feet north of SE. corner, sec. 23, T. 28 S., R. 42 W.):

Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft when dry, friable when moist; noncalcareous; clear, smooth boundary.

B2t—5 to 17 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to weak and moderate, medium, subangular blocky; hard when dry, firm when moist; thin, nearly continuous clay films; noncalcareous; clear, smooth boundary.

B3ca—17 to 23 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; very weak, coarse, prismatic structure that parts to very weak, medium, subangular blocky; hard when dry, firm when moist; thin, patchy clay skins; very strongly calcareous; clear, smooth boundary.

C1ca—23 to 41 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive; slightly hard when dry, friable when moist; about 5 percent lime spots; very strongly calcareous; clear, smooth boundary.

C2—41 to 60 inches, pale-brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) when moist; massive; slightly hard when dry, friable when moist; very strongly calcareous.

The A horizon ranges from 3 to 10 inches in thickness and from loam to light silty clay loam in texture. The B2t horizon ranges from 8 to 18 inches in thickness and from silty clay loam to clay in texture.

Richfield silt loam, 0 to 1 percent slopes (RcA).—This soil occurs in the eastern part of the county.

Included in mapping were small areas of Ulysses and Norka silt loams, small areas of Baca clay loam near Two Buttes, and small areas of Dalhart sandy loam near the southeastern part of the county.

This soil has medium surface runoff and moderate permeability.

Most of the acreage is cultivated. Small grain and sorghum are the major crops. In irrigated areas, fertilization, use of crop residue, and water management are necessary for producing high crop yields. Stubble mulching and stripcropping help control soil blowing; during periods of drought, deep listing and chiseling are necessary. (Capability unit I-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Rough Stony Land

Rough stony land (3 to 65 percent slopes) (Ro) occurs in the southwestern part of the county. It consists of steep stony areas below sandstone and basalt outcrops. The area is covered with rock that has broken off the outcrops and rolled down the slopes. Included in mapping were small areas of Kim soils in less sloping areas.

This land type has varying amounts of sandstone, and outcrops of both sandstone and shale are common. The surface is generally stony loam, but ranges from stony sandy loam to clay loam and gravelly loam. Rough stony land shows no profile development other than a slightly darkened surface layer.

Surface runoff is rapid, and permeability is moderate. Gullying is a constant hazard.

All of the acreage is used as range. The vegetation is mainly big and little bluestem, side-oats grama, blue grama, and cedar trees. Cattle graze on the more gentle slopes, but some of the slopes are too steep to permit grazing. Proper range management practices, such as deferred and rotation grazing, are necessary to protect the soil from erosion. (Capability unit VIIs-4, nonirrigated; Sandstone Breaks range site)

Thedalund Series

The Thedalund series consists of moderately deep, gently sloping, light-colored loams that overlie shale.

In a typical profile the surface layer is grayish-brown, very strongly calcareous clay loam about 2 inches thick. The transitional layer, about 7 inches thick, is light brownish-gray silty clay loam that is very strongly calcareous and contains many small chips of limestone. The underlying material is light brownish-gray and pale-yellow clay loam that overlies shale at a depth of about 30 inches.

Thedalund soils are well drained. Runoff is rapid, permeability is moderately slow, and the available water capacity is moderate.

All of the acreage is in native range. The vegetation is mainly buffalograss, blue grama, galleta, yucca, and snakeweed.

Typical profile of Thedalund silty clay loam (1,600 feet south of the crossing of Two Buttes Creek and Highway No. 101, and 12 feet east of the road in sec. 10, T. 29 S., R. 49 W.):

A1—0 to 2 inches, grayish-brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, fine, granular structure; hard when dry, firm when moist; very strongly calcareous, pH 8.2; clear, smooth boundary.

AC—2 to 9 inches, light brownish-gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; hard when dry, firm when moist; small limestone chips; very strongly calcareous, pH 8.4; clear, smooth boundary.

C1ca—9 to 13 inches, light brownish-gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; hard when dry, firm when moist; small limestone chips; very strongly calcareous, pH 8.4; clear, smooth boundary.

C2ca—13 to 30 inches, pale-yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) when moist; weak, fine, subangular blocky structure; hard when dry, firm when moist; few gypsum crystals; very strongly calcareous, pH 8.0; clear, smooth boundary.

R—30 to 60 inches, gypsiferous clayey shale.

The texture of the A horizon ranges from clay loam to silty clay loam. Texture of the C horizon ranges from clay loam to loam. Depth to shale ranges from 20 to 40 inches.

Thedalund silty clay loam (0 to 6 percent slopes) (Th).—This soil occurs on shale slopes below limestone outcrops in the northwestern quarter of the county.

Included in mapping were small areas of Penrose channery loam on the steeper slopes and Minnequa and Manvel loams on the gentler slopes.

This soil is subject to severe gullying, if the cover vegetation is not maintained.

All of the acreage is in native range. The vegetation is mainly galleta, blue grama, and snakeweed. Proper range management practices, such as deferred and rotation grazing, are necessary to control erosion. (Capability unit VIe-2, nonirrigated; Shaly Plains range site)

Tivoli Series

The Tivoli series consists of deep, gently sloping to undulating, hummocky and dunelike loose sands. These soils are mainly in the southeastern part of the county near the Cimarron River.

In a typical profile the surface layer, about 6 inches thick, is pale-brown sand that is free of lime. It overlies yellowish-brown sand that is commonly many feet thick.

Tivoli soils are excessively drained. Internal drainage is rapid and permeability is rapid. The available water capacity is low. These soils are low in natural fertility and are very susceptible to soil blowing.

Most of the acreage is in native range. The vegetation is mainly sand lovegrass, sand sage, and sand dropseed.

Typical profile of Tivoli sand (500 feet east and 60 feet south of NW. corner, sec. 29, T. 32 S., R. 48 W.):

A1—0 to 6 inches, pale-brown (10YR 6/3) sand, dark brown (10YR 3/3) when moist; single grain; loose when dry, very friable when moist; noncalcareous; clear, wavy boundary.

C—6 to 60 inches, yellowish-brown (10YR 5/4) sand; dark yellowish brown (10YR 4/4) when moist; single grain; loose when dry, very friable when moist; noncalcareous.

The A horizon ranges from 4 to 10 inches in thickness and from sand to loamy sand in texture. The C horizon is mostly sand, but in some areas it is light loamy sand.

Tivoli sand (1 to 9 percent slopes) (Tn).—This soil occurs primarily in the southwestern quarter of the county.

Included in mapping were small areas of Otero sandy loam; Vona soils, eroded; and Vona loamy sand and sandy loam.

This soil has rapid internal drainage, rapid permeability, low available water capacity, and low natural fertility. It is very susceptible to soil blowing.

This soil is not suited to cultivation. The vegetation is mainly sand sage and tall grasses. Proper range management practices, such as deferred grazing and rotation grazing, help to control soil blowing. (Capability unit VIe-4, nonirrigated; Deep Sand range site)

Tivoli-Dune land complex (4 to 20 percent slopes) (To).—This complex parallels the Cimarron River in the southeastern corner of the county. About 35 percent of each area is Tivoli sand, and about 25 percent is small to fairly large active blowouts and old blowouts that are partly revegetated. Included in mapping were areas of Otero, Vona, and Manter soils that occupy about 40 percent of each mapped area.

This mapping unit is not suited to cultivation because of the hazard of soil blowing. It is suited to range, but deferred grazing is essential. Blowouts should be reseeded to grass. Before reseeding, the surface must be stabilized with mulch to prevent soil blowing. Establishing vegetation is difficult. (Capability unit VIIe-1, nonirrigated; Choppy Sand range site)

Travessilla Series

The Travessilla series consists of shallow stony sandy loams that developed in material weathered from sandstone.

In a typical profile the surface layer, about 9 inches thick, is grayish-brown, strongly calcareous stony sandy loam. It contains many sandstone chips and is underlain by sandstone.

Travessilla soils are well drained. Because of the sloping and broken topography, surface runoff is rapid. Available water capacity and fertility are low.

All of the acreage is in native range. The vegetation is mainly blue grama, side-oats grama, little bluestem, and cedar trees.

Typical profile of Travessilla stony sandy loam (1,056 feet east and 1,060 feet south of NW. corner, sec. 30, T. 29 S., R. 50 W.):

A—0 to 9 inches, grayish-brown (10YR 5/2) stony sandy loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft when dry, very friable when moist; scattered sandstone chips; strongly calcareous; clear, smooth boundary.

R—9 to 60 inches, hard sandstone that in the top 2 or 3 inches is slightly weathered, with a few cracks.

The Travessilla soils range in depth to sandstone from 4 to 20 inches. The content of sandstone rock ranges from a few chips to 50 percent.

Travessilla stony sandy loam (1 to 25 percent slopes) (Tr).—This soil occurs primarily in the western part of the county.

Included in mapping were small areas of Baca clay loam, Kim loam, and sandstone outcrops.

This soil has rapid surface runoff and low available water capacity and fertility.

All of the acreage is in native range. The common vegetation is blue grama, side-oats grama, little bluestem, and cedar trees. Proper range management practices, such as deferred grazing, help improve the grass cover. (Capability unit VIIs-4, nonirrigated; Sandstone Breaks range site)

Ulysses Series

The Ulysses series consists of deep, nearly level to gently sloping, dark-colored silt loams (fig. 6) that are on uplands along the eastern boundary of the county.

In a typical profile the surface layer, about 7 inches thick, is dark grayish-brown silt loam. The subsoil is about 16 inches thick. The upper part is brown light clay loam and the lower part is pale-brown loam. The underlying material is a light yellowish-brown and very pale brown loam that is friable, contains lime, and is easily penetrated by plant roots.

Ulysses soils are well drained. They absorb water well and have moderate permeability and high available water capacity. These soils are fertile, but respond to commercial fertilizers where irrigated. They are susceptible to both soil blowing and water erosion unless protected with a vegetative cover.

Most of the acreage is cultivated. Wheat and sorghum are the major crops in both dryland and irrigated areas. In areas of native range, buffalograss and blue grama are the principal grasses.

The Ulysses soils in Baca County are mapped with Norka soils.

Typical profile of Ulysses silt loam (50 feet east and 2,640 feet south of NW. corner, sec. 29, T. 30 S., R. 42 W.):

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft when dry, friable when moist; weakly calcareous, pH 8.0; clear, smooth boundary.

B2—7 to 12 inches, brown (10YR 5/3) light clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist; weakly calcareous, pH 7.9; clear, smooth boundary.

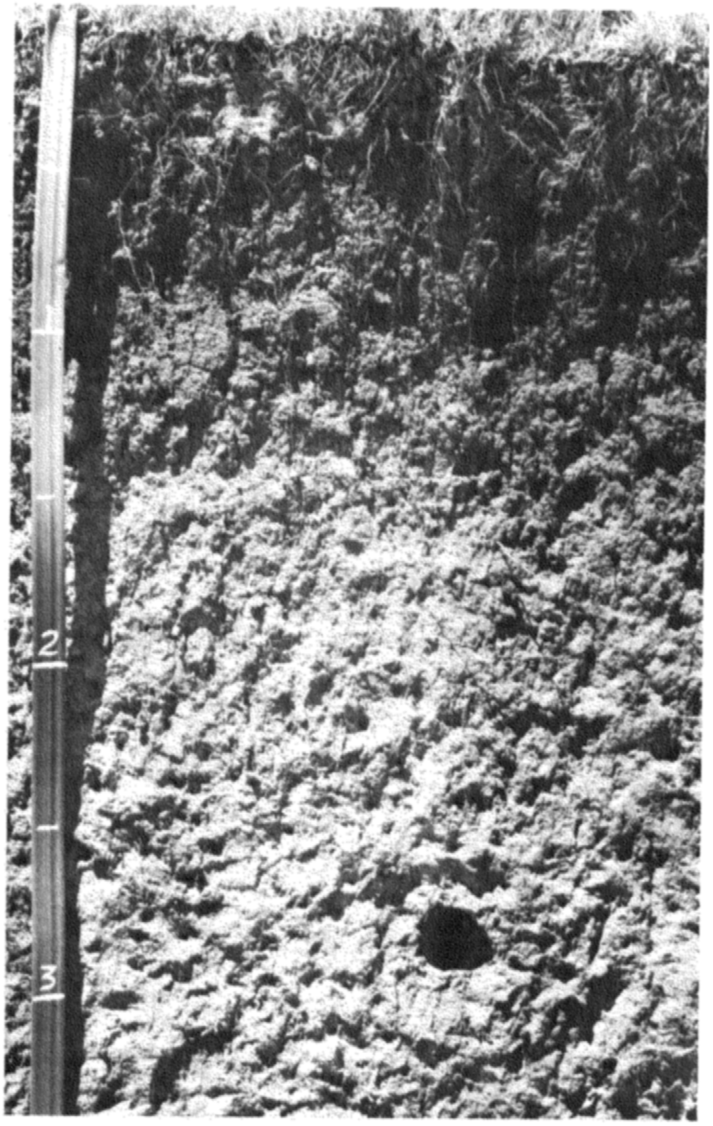

Figure 6.—Profile of a Ulysses silt loam.

B3—12 to 23 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; hard when dry, friable when moist; strongly calcareous, pH 7.8; clear, smooth boundary.

C1ca—23 to 45 inches, light yellowish-brown (10YR 6/4) loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, friable when moist; some visible calcium carbonate concretions; very strongly calcareous, pH 7.8; gradual, wavy boundary.

C2—45 to 60 inches, very pale brown (10YR 7/3) loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, friable when moist; strongly calcareous, pH 7.8.

The A horizon ranges from 3 to 10 inches in thickness and from loam to light silty clay loam in texture. The B2 horizon ranges from 4 to 12 inches in thickness and from heavy loam to clay loam in texture. In some cultivated areas the soil is calcareous to the surface.

Ulysses and Norka silt loams, 0 to 1 percent slopes (UnA).—This unit occurs in the eastern part of the county. It is made up of nearly equal amounts of Ulysses and Norka soils. Included in mapping were small areas of Richfield silt loam, 0 to 1 percent slopes, and Baca clay loam.

Most of the acreage is cultivated. Winter wheat and sorghum are the main crops. In irrigated areas, fertilization, use of crop residue, and water management are necessary. Stubble mulching and stripcropping help control soil blowing, but during periods of drought, deep listing and chiseling are also needed. (Capability unit I-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Ulysses and Norka silt loams, 1 to 3 percent slopes (UnB).—This unit occurs in the eastern part of the county. Generally it is gently sloping, but in places it is undulating. It is made up of nearly equal amounts of Ulysses and Norka soils.

Nearly all of the acreage is cultivated. Winter wheat and sorghum are the main crops on both dryland and irrigated areas. Because of the slope, more care must be taken to control water runoff than on slopes of 0 to 1 percent. In irrigated areas, land leveling, fertilization, stubble mulching, and stripcropping help control soil blowing, but during periods of drought, deep listing and chiseling are also needed. (Capability unit IIe-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Vona Series

The Vona series consists of deep, nearly level to gently sloping and undulating, light-colored sandy loams and loamy sands.

In a typical profile the surface layer is pale-brown, noncalcareous sandy loam about 15 inches thick. The subsoil, about 15 inches thick, is light brownish-gray sandy loam that is hard when dry and firm when moist. The underlying material is light yellowish-brown sandy loam that is underlain by light yellowish-brown sand at a depth of about 48 inches.

Vona soils are well drained and have rapid permeability and moderate available water capacity.

Most of the acreage is cultivated. Broomcorn and sorghum are the main crops in both dryland and irrigated areas. In areas of range, sand lovegrass, sand dropseed, and sand sagebrush are common.

Typical profile of Vona sandy loam (2,100 feet east and 50 feet south of NW. corner, sec. 25, T. 32 S., R. 49 W.):

A1—0 to 15 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; soft when dry, friable when moist; noncalcareous; clear, smooth boundary.

B2t—15 to 30 inches, light brownish-gray (10YR 6/2) sandy loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; hard when dry, firm when moist; thin, patchy clay skins; few lime spots; weakly calcareous in upper 10 inches, strongly calcareous in lower 5 inches; gradual, smooth boundary.

C1—30 to 48 inches, light yellowish-brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) when moist; massive; slightly hard when dry, friable when moist; lime spots; strongly calcareous; clear, smooth boundary.

C2—48 to 60 inches, light yellowish-brown (10YR 6/4) sand, yellowish brown (10YR 5/4) when moist; massive to single grain; loose when dry, very friable when moist; strongly calcareous.

The A horizon ranges from 5 to 20 inches in thickness and from loamy sand to sandy loam in texture. The B2t horizon is from 5 to 20 inches thick. Depth to lime ranges from 8 to 20 inches.

Vona loamy sand, 0 to 3 percent slopes (VnB).—This soil occurs throughout the county. The surface layer, about 18 inches thick, is loamy sand. The subsoil is sandy loam about 12 inches thick. The underlying material ranges from loamy sand to loam, but most commonly is sandy loam.

Included in mapping were small areas of Tivoli sand and Otero sandy loam.

In cultivated areas, soil blowing is the major hazard.

About 30 percent of the acreage is cultivated, but most of it is in native range. Sorghum and broomcorn are the main crops. After harvest, a tall stubble must be left standing to protect the sandy surface from soil blowing. The range vegetation is mainly blue grama, sand dropseed, and sand sage. Proper range management practices, such as deferred grazing and reseeding, are necessary to help prevent soil blowing. (Capability unit IVe-4, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Vona sandy loam, 3 to 5 percent slopes (VoC).—This soil occurs as small areas throughout the county. This soil has the profile described as typical for the series.

Included in mapping were small areas of Vona loamy sand and Tivoli sand, and small scattered areas of Otero sandy loam.

This soil has slow surface runoff, medium internal drainage, and moderate available water capacity.

Most of the acreage is in native range. The vegetation is mainly sand sage, yucca, blue grama and side-oats grama. Because soil blowing is very difficult to control, only a small part of the acreage is cultivated. Most cultivated areas are small and lie within fields of Manter and Vona sandy loams, 1 to 3 percent slopes. Broomcorn and sorghum are main crops. The cultivated areas should be reseeded to grasses, such as sand lovegrass. On range, proper management is necessary to control soil blowing. (Capability unit VIe-3, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Vona soils, eroded (0 to 5 percent slopes) (Vr2).—These soils occur as small areas throughout the county, but primarily in the southern half. The surface layer is sandy loam to loamy sand as much as several inches thick. In places it has been removed through erosion (fig. 7). The subsoil is sandy loam about 4 inches thick. In some places, lime is on the surface, and in others, it is several inches below the surface, depending on the amount of deposition or blowout.

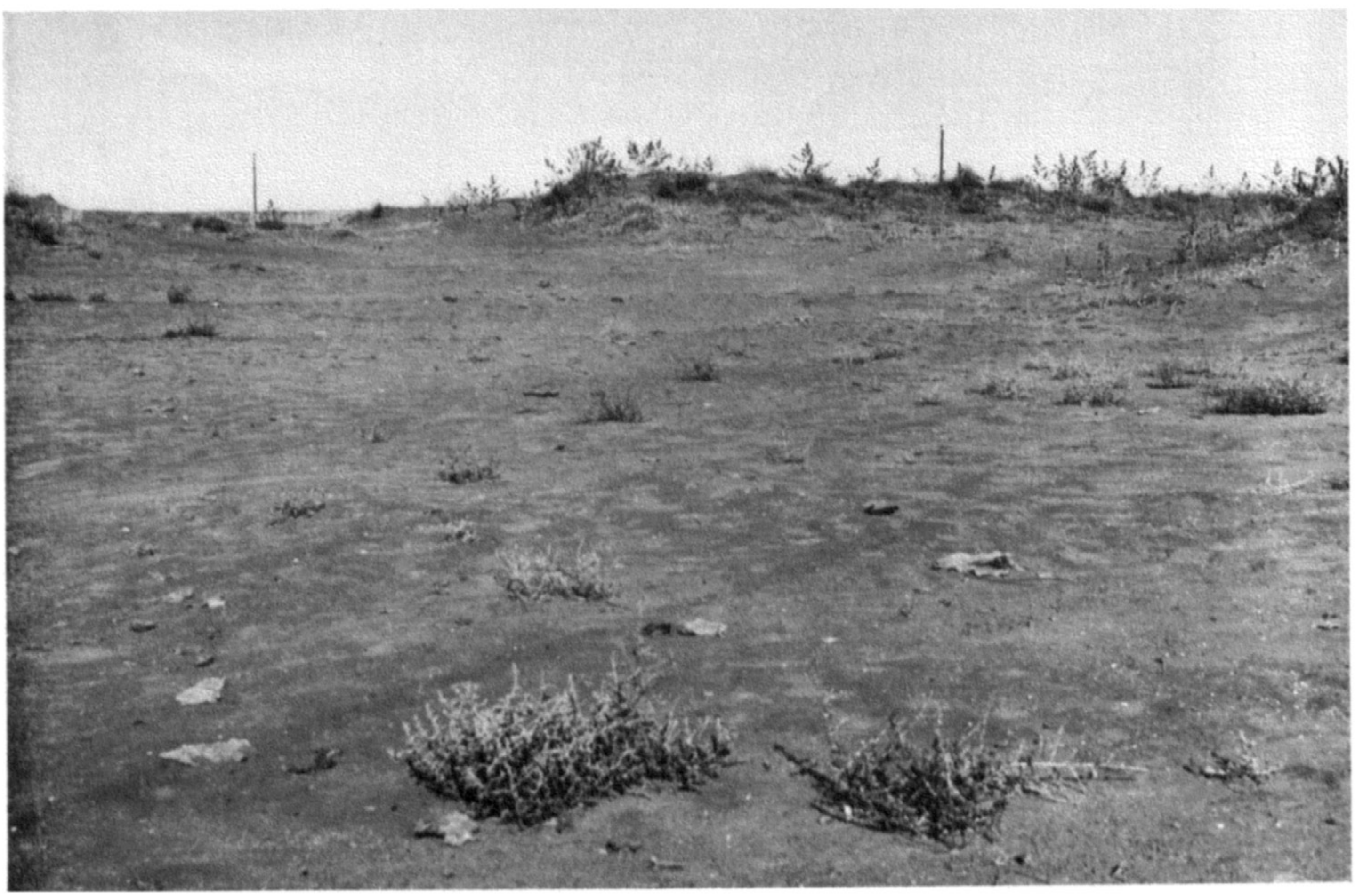

Figure 7.—Vona soils eroded by wind.

Included in mapping were areas of Otero sandy loam and Tivoli sand.

These soils have moderately slow runoff and moderate available water capacity. Soil blowing is a severe hazard.

Nearly all of the acreage is cultivated, or has been cultivated. Broomcorn and sorghum are the main crops, but in some years they have not provided adequate cover and the soil has been eroded. A vegetative cover is necessary at all times. The cultivated acreage should be reseeded to grass, but this is difficult. On range, proper management practices are necessary to control soil blowing. (Capability unit VIe-3, nonirrigated; Sandy Plains range site; Sandy windbreak suitability group)

Wages Series

The Wages series consists of deep, nearly level, dark-colored loams that occupy stream terraces throughout the county.

In a typical profile the surface layer is brownish-gray loam about 4 inches thick. The subsoil, about 8 inches thick, is a grayish-brown clay loam that is strongly calcareous in the lower few inches. It is hard when dry and firm when moist. The underlying material is brown, strongly calcareous, weakly stratified clay loam.

Wages soils are well drained and have high available water capacity.

Most of the acreage is in native grass, mainly buffalograss and blue grama. In cultivated areas, wheat and sorghum are the main crops.

Typical profile of Wages loam (1,056 feet north and 40 feet west of SE. corner, sec. 4, T. 29 S., R. 42 W.):

A1—0 to 4 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist; noncalcareous, pH 7.5; abrupt, smooth boundary.

B2t—4 to 8 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium to fine, subangular blocky; hard when dry, firm when moist; thin, patchy clay skins; noncalcareous, pH 7.6; clear, smooth boundary.

B3—8 to 12 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; hard when dry, firm when moist; strongly calcareous, pH 7.8; clear smooth boundary.

C—12 to 60 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) when moist; very weak, medium, subangular blocky structure; hard when dry, friable when moist; strongly calcareous, pH 8.1.

In most places, depth to lime ranges from 7 to 12 inches, but some cultivated areas are limy to the surface. The texture of the B2t horizon ranges from loam to clay loam.

Wages loam (0 to 3 percent slopes) (Wa).—This soil lies along stream terraces in nearly all parts of the county.

Included in mapping were small areas of McCook loam, Baca clay loam, and Nunn clay loam.

These soils absorb water readily. They are moderately permeable and have high available water capacity.

Most of the acreage is in native vegetation. Buffalograss and blue grama are the main grasses. Wheat and sorghum are the main cultivated crops. In irrigated areas, fertilization, land leveling, use of crop residue, and water management are necessary for producing good crop yields and controlling soil blowing. Stubble mulching and stripcropping are needed in irrigated and dryfarmed areas, and during periods of drought, deep listing and chiseling help control soil blowing on dryfarmed areas. On range, deferred and rotation grazing help maintain adequate grass cover. (Capability unit IIe-1, irrigated, and capability unit IIIc-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Wiley Series

The Wiley series consists of deep, nearly level to strongly sloping, light-colored loams on loess-mantled uplands in nearly all parts of the county.

In a typical profile the surface layer is light brownish-gray loam about 5 inches thick. The subsoil is about 10 inches thick. The upper part is grayish-brown, slightly calcareous silty clay loam, and the lower half is pale-brown, strongly calcareous silt loam. The subsoil is hard when dry, but friable when moist. The underlying material is pale-brown silt loam that is friable, contains lime, and is easily penetrated by plant roots.

Wiley soils are naturally well drained. These soils are moderately permeable and have high available water capacity. They are high in natural fertility, but are susceptible to both soil blowing and water erosion.

Most of the acreage in the eastern part of the county is cultivated; most of the acreage in the western part is in native range. Wheat and sorghum are the common crops in both dryfarmed and irrigated areas. Blue grama and buffalograss are common on range.

Typical profile of Wiley loam (165 feet south and 50 feet west of NE. corner, sec. 6, T. 29 S., R. 45 W.):

A1—0 to 5 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; slightly hard when dry, very friable when moist; small lime concretions; strongly calcareous; clear, smooth boundary.

B2t—5 to 10 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak to moderate, medium, prismatic structure that parts to weak to moderate, medium, subangular blocky; hard when dry, friable when moist; thin, patchy clay skins; weakly calcareous; clear, smooth boundary.

B3ca—10 to 15 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 4/3) when moist; very weak to weak, medium, subangular blocky structure; hard when dry, friable when moist; strongly calcareous; clear, smooth boundary.

C—15 to 60 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 5/3) when moist; massive; hard when dry, friable when moist; about 5 percent lime spots; strongly calcareous.

The A horizon ranges from 2 to 7 inches in thickness and from silt loam or loam to light silty clay loam in texture. The B2t horizon ranges from 3 to 10 inches in thickness. The more sloping Wiley soils generally have less clay in their B horizon. A IIC2 horizon of outwash or alluvial loamy materials occurs between depths of 40 and 60 inches in some areas.

Wiley loam, 0 to 1 percent slopes (WlA).—This soil occurs as relatively large areas throughout the county.

Included in mapping were many small areas of Baca clay loam, and in the northeastern part of the county, some areas of Colby silt loam and Harbord loam.

This soil absorbs nearly all of the moisture that falls

on it, and surface runoff is slow. Where this soil is irrigated, conservation of moisture and control of soil blowing are the major problems.

About 70 percent of the acreage is cultivated. Wheat and sorghum are the main crops. In irrigated areas, proper water management is necessary. Stubble mulching and stripcropping help control soil blowing, but during periods of drought, deep listing and chiseling are needed. On range, proper management practices, such as deferred grazing, are necessary for controlling soil blowing and improving the vegetative cover. (Capability unit I-1, irrigated, and capability unit IVe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Wiley loam, 1 to 3 percent slopes (WlB).—This soil occurs throughout the county. This soil has a profile like that described as typical for the series except that it is gently sloping and permits more runoff.

Included in mapping were small areas of Baca clay loam, Harbord loam, and Colby silt loam.

Where this soil is irrigated, land leveling and careful water management are necessary for producing high crop yields and controlling soil blowing. Because of the slope, stubble mulching and stripcropping are necessary to help control soil blowing, but during periods of drought, deep listing and chiseling are also necessary. On range, proper management practices are necessary. (Capability unit IIe-1, irrigated, and capability unit IVe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Wiley loam, 3 to 5 percent slopes (WlC).—This soil occurs mainly in the northern half of the county. It has a profile similar to that described as typical for the series except that the subsoil is light clay loam that is about 8 inches thick. The subsoil is slightly calcareous.

Included in mapping were small areas of Colby silt loam, Harbord loam, and Harvey loam.

Where this soil is cultivated, soil blowing and loss of water through runoff are severe hazards.

Most of the acreage is used as range, but a small percentage is cultivated. Blue grama and buffalograss are the major grasses. In cultivated areas, terracing, contour farming, and stubble-mulch tillage are necessary for controlling erosion and conserving moisture. On range, proper management practices, such as deferred grazing and contour furrowing, help control soil blowing and water erosion. (Capability unit IIIe-2, irrigated, and capability unit IVe-2, nonirrigated; Loamy Plains range sites; Loamy windbreak suitability group)

Wiley loam, 5 to 9 percent slopes (WlD).—This soil occurs in small areas throughout the county, but is mainly in the northern half. The total acreage is small. The profile differs from that described as typical for the series in having a thinner surface layer and subsoil, and in having a subsoil that is calcareous throughout.

Included in mapping were small areas of Colby, Harvey, and Harbord loams. Runoff is moderately rapid where the cover vegetation is adequate, and rapid where the cover is inadequate.

All of the acreage is in native vegetation. Blue grama and buffalo are the major grasses. Proper range management practices, such as deferred grazing and contour furrowing, are necessary to help prevent soil blowing and water erosion. Because of the rapid surface runoff, re-establishing cover is difficult. (Capability unit VIe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Wiley soils, eroded (0 to 5 percent slopes) (Ws2).—These soils occur in small areas throughout the county. The surface layer is loam or silty clay loam, is thin, and in places has been removed through erosion. In some areas, lime spots are on the surface. In many places surface soil material has blown into and covered fences. In many cultivated areas subsoil material is mixed into the surface layer. In about 70 percent of each mapped area, blocky subsoil aggregates are on the surface, and in about 20 percent there are hummocks 1 to 3 feet high.

Included in mapping were noneroded areas of Wiley loam that make up about 10 percent of each mapped area.

Surface runoff is medium to rapid. Because the surface layer is eroded, this soil does not take in water as rapidly as the soil described as typical for the series. It has a moderate to slow water intake rate.

Most of the acreage is cultivated. Wheat and sorghum are the main crops. Stubble mulching and stripcropping help prevent erosion. (Capability unit IVe-1, nonirrigated; Loamy Plains range site; Loamy windbreak suitability group)

Use and Management of the Soils

This section discusses the use of the soils for crops, the system of capability grouping, and the management of the soils in Baca County by capability groups. Predicted crop yields under two levels of management are furnished. Also discussed is management of soils for range, windbreaks, wildlife, recreation, and engineering works.

Use of Soils for Crops [2]

Slightly more than half of Baca County is used for crops. About 818,000 acres is dryfarmed, and about 20,000 acres is irrigated.

In irrigated areas, wheat and grain sorghum are the most extensively grown crops, but the acreage of sugar beets, corn, and alfalfa is increasing annually. In dryfarmed areas, wheat is the most extensively grown crop, followed in acreage by grain sorghum, broomcorn, and forage sorghum.

The main factor limiting nonirrigated crop production in this county is the shortage of available moisture. Precipitation is marginal for crops, and distribution and frequency are erratic. Severe droughts of long duration accompanied by high winds are common.

In general, precipitation is more favorable for crop production on the eastern boundary of the county and decreases gradually toward the west. The drier western parts of the county produce good crops in years of high precipitation, but these years are less frequent than in the eastern parts.

A summer fallow system of farming is normally used

[2] JAMES BRUNER, agronomist, Soil Conservation Service, assisted with this section.

for nonirrigated crops. This system uses a year of fallow to store moisture in the soil before a crop is seeded. Broomcorn, or less frequently sorghum, is grown on some areas of sandy soils. These crops are planted each year to protect the soils from blowing. Terraces and contour farming are used by some farmers to reduce runoff and store more moisture for crops.

Soil blowing is severe during extended droughts. Management of crop residue is necessary to provide a protective cover for the soils. Practices that farmers commonly use to control soil blowing are stubble mulching, stripcropping, harvesting in such a way as to leave tall stubble, and delaying tillage until after the windy period late in winter and early in spring. In those instances where the practices just mentioned do not provide enough plant cover, emergency tillage that brings clods to the surface is necessary to control soil blowing.

Most of the irrigated crops of Baca County are watered from wells. These wells, installed since about 1950, presently number about 280. Each year new wells are dug and new areas are irrigated. Most of the wells are near Walsh and Vilas. These deep wells produce 350 to 3,000 gallons per minute of good-quality water. A small area in Baca County is irrigated with water from Two Buttes Reservoir. This reservoir depends on the Two Buttes Creek drainage, and in many years the quantity is short of that needed for full irrigation.

Management of irrigation so that crops receive water as needed and waste of water is held to a minimum is the primary problem on irrigated lands. Most of the irrigated fields have been leveled to aid in distribution of water. Concrete-lined ditches are popular because they reduce the amount of water lost through seepage. Furrow irrigation is used for sugar beets, sorghums, corn, and most fields of wheat. Flood irrigation is used for alfalfa and some fields of wheat.

Phosphate and nitrogen fertilizers are needed for best yields on all the irrigated soils. Crops on Colby, Ulysses, and Norka soils may also respond to light applications of zinc and iron.

Capability classification system

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soils are grouped at three levels, the capability class, subclass, and unit.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I. Soils have few limitations that restrict their use.

Class II. Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV. Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V. Soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (There are no soils of this class in Baca County.)

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral

specifically identifies the capability unit within each subclass.

Management by capability units

In the following pages the capability units in Baca County are described and suggestions for the use and management of the soils are given. All the soils in the county have been placed in nonirrigated capability units, but only those soils suitable for irrigation have been placed in irrigated capability units.

CAPABILITY UNIT I-1, IRRIGATED

This unit consists of deep, well-drained, nearly level soils that have a loam, silt loam, or light clay loam surface layer. These soils are easily worked and have a high available water capacity. Soil moisture is readily available to plants. The erosion hazard is slight.

These soils are suited to all crops grown in the county. Irrigation can be by furrows (fig. 8), corrugations, or borders. Border irrigation can be used on leveled land to irrigate close-growing crops such as small grains and legumes. In places, land smoothing is needed for better water management.

CAPABILITY UNIT I-2, IRRIGATED

This unit consists of Dalhart sandy loam, 0 to 1 percent slopes, a deep, well-drained, nearly level soil. The surface layer is a sandy loam, but the underlying layer is a loam, clay loam, or sandy clay loam. This soil is easily worked and takes in water rapidly. It has a high available water capacity, and the moisture is readily available to plants. Prevention of soil blowing is the primary management problem.

This soil is excellent for crop production and is suited to all crops of the survey area. Leaving stubble or crop residue on the surface helps control soil blowing. Use of fertilizer maintains or improves fertility. Land smoothing improves water management on borders and corrugations.

CAPABILITY UNIT IIe-1, IRRIGATED

This unit consists of deep, well-drained, gently sloping soils that have a light clay loam, loam, or silt loam surface layer. These soils take in water at a medium rate and have a high available water capacity. Soil moisture is readily available to plants. The primary management problem is controlling water erosion.

These soils are well suited to all crops of the survey area. A rotation system that includes a deep-rooted legume helps maintain tilth and reduce erosion. Across-the-slope irrigation and irrigating with short irrigation heads reduce erosion. Where furrow and border irrigation are used, land leveling is necessary for even distribution of water.

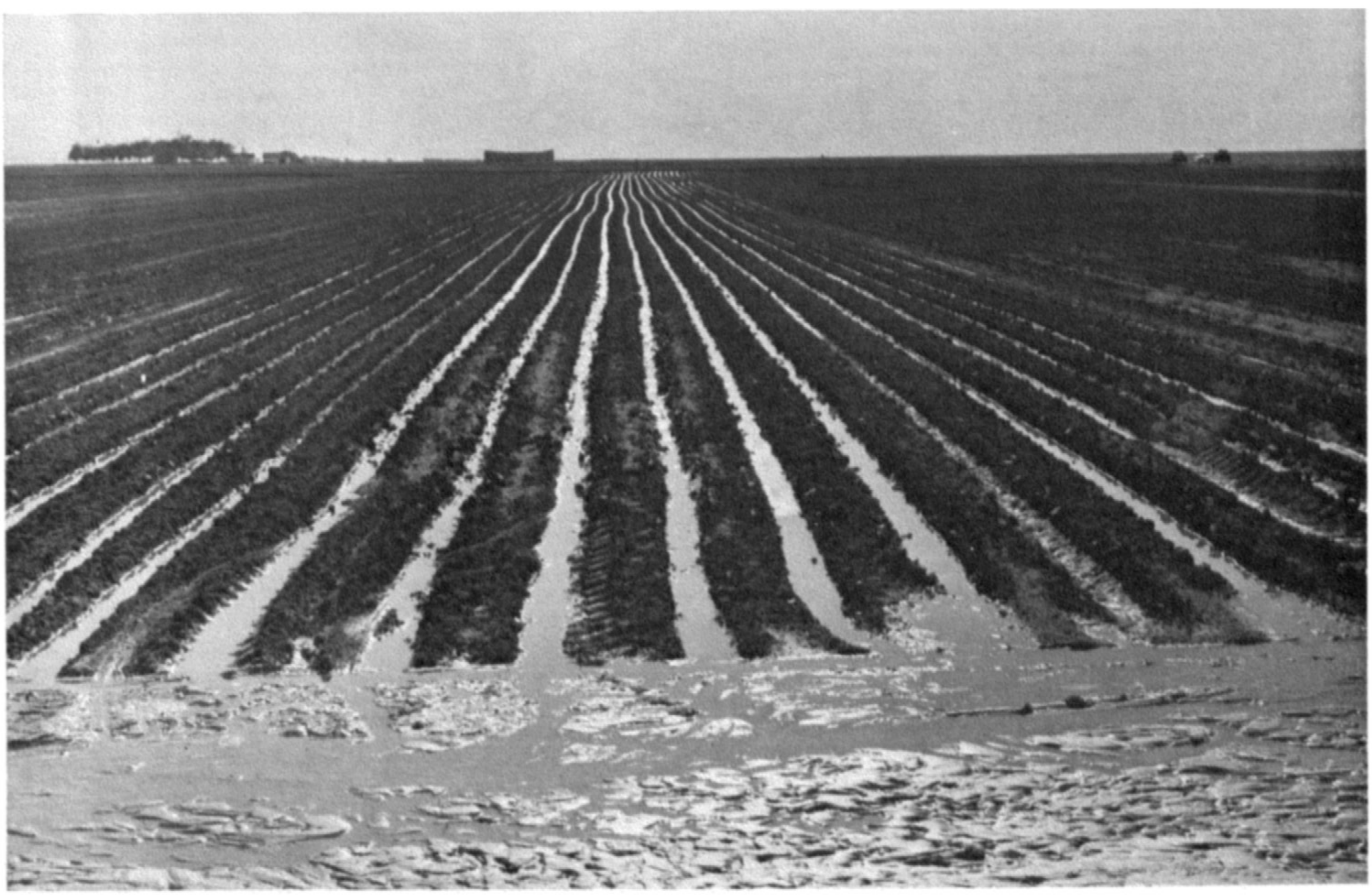

Figure 8.—Furrow irrigation on Baca clay loam, 0 to 1 percent slopes.

CAPABILITY UNIT IIe-2, IRRIGATED

This unit consists of Dalhart sandy loam, 1 to 3 percent slopes, a deep, well-drained, gently sloping soil that has a sandy loam surface layer and a sandy clay loam subsoil. This soil takes in water readily and has a high available water capacity. The main management problems are controlling erosion and maintaining high fertility.

This soil is well suited to all crops of the survey area. Commercial fertilizer maintains soil fertility if applied at rates determined by both soil tests and the needs of the crop. Including a close-growing crop in the rotation maintains organic matter and protects the soil from duststorms in winter. Land leveling makes even application of water easier. Short irrigation heads reduce erosion.

CAPABILITY UNIT IIs-1, IRRIGATED

This unit consists of deep, well-drained, nearly level soils that have a clay loam surface layer and a clay subsoil. These soils absorb water slowly, but have high available water capacity. They are difficult to work, but are suited to all crops of the survey area.

A rotation that includes a deep-rooted legume and a close-growing small grain is common. Plowing the field in the fall is beneficial. Commercial fertilizer, barnyard manure, or a green-manure crop is needed to maintain tilth. Furrow and border irrigation are commonly used. These soils develop hard pans, and deep chiseling or subsoiling is beneficial.

CAPABILITY UNIT IIs-2, IRRIGATED

This unit consists of deep, well-drained, nearly level sandy loams. These soils take in water rapidly and have a moderate available water capacity. They are easily leached of plant nutrients and are easy to work. Soil blowing is a severe hazard.

These soils are suited to all crops of the survey area. A rotation with legumes and close-growing small grains increases the content of organic matter and prevents soil blowing. Keeping crop residue on the soil and using fertilizer help maintain cover vegetation. Furrow and flood irrigation are commonly used, but irrigation runs need to be shorter than on more loamy soils because of the rapid permeability.

CAPABILITY UNIT IIIc-1, NONIRRIGATED

This unit consists of nearly level soils that have a surface layer and subsoil of loam. These soils contain more organic matter and have higher natural fertility than the other soils in the county.

The soils in this unit are easy to work. Normally they have a moderate water intake rate, but they have a medium runoff during a high-intensity rain. Runoff is highest where cultivation and dry weather have made the surface layer powdery and loose.

Nearly all of these soils are used for crops. They produce the highest wheat yields of all the nonirrigated soils in the county. They also produce good yields of sorghums. Summer fallowing is used, and wheat-fallow or wheat-sorghum-fallow is the common cropping sequence. Stubble mulching is used to maintain crop residue on the surface, which will reduce soil blowing and water erosion. When droughts occur and crops fail, listing and chiseling help control soil blowing.

The small areas of these soils that are in native grass have a cover mainly of blue grama.

CAPABILITY UNIT IIIe-1, IRRIGATED

This unit consists of deep, well-drained, nearly level to gently sloping sandy loams on uplands. These soils take in water at a rapid rate and have a moderate available water capacity. They are easily leached of nutrients and are easily worked, but have a severe hazard of soil blowing.

The common crops grown are sorghum and wheat. It is necessary to maintain enough cover on the soil to protect it from soil blowing. Use of crop residue helps maintain a cover on the soil, increase the content of organic matter, and prevent soil blowing. Use of fertilizer also helps produce cover in amounts adequate to protect the soil. Furrow or flood irrigation is commonly used, but irrigation runs need to be short because of the rapid rate of water intake.

CAPABILITY UNIT IIIe-2, IRRIGATED

This unit consists of deep, well-drained, sloping loams and clay loams. These soils take in water at a medium rate and have high available water capacity. They are subject to a severe hazard of water erosion if not irrigated properly.

The common crops grown are wheat and sorghum. Water should be applied slowly and controlled closely so that it does not wash down. Land leveling helps obtain better control of water and makes possible the reduction of irrigation grades by using across-the-slope furrows. Irrigation runs should be short.

CAPABILITY UNIT IIIe-3, IRRIGATED

This unit consists of deep, well-drained, nearly level to gently sloping loamy sands. These soils take in water rapidly and have a moderate available water capacity.

Broomcorn, sorghum, and wheat are the common crops grown. These soils are subject to a severe hazard of soil blowing if the surface is not protected by plant residue or close-growing crops. Danger of erosion limits the length of irrigation runs. Sprinkler systems can be used effectively. Fertilizers help produce adequate amounts of cover vegetation and crop residue. In many places, these soils are low in zinc content.

CAPABILITY UNIT IIIe-4, NONIRRIGATED

This unit consists of nearly level soils that have a sandy loam surface layer and a sandy clay loam subsoil.

The sandy loam surface layer is easy to work, takes in water at a rapid rate, and has a high available water capacity. Control of soil blowing is the major management problem.

Most of these soils are cultivated. Wheat, broomcorn, and grain sorghum are the primary crops. Summer fallowing is used in places, but it is necessary to maintain plant residue on the surface. Stripcropping and stubble mulching are common practices. Chiseling and listing are necessary during periods of drought when there is not enough plant residue to protect the soil.

Small areas have a cover of blue grama and buffalograss and are used for grazing. Mid grasses, such as little bluestem, occur with blue grama, in some places.

CAPABILITY UNIT IVe-1, NONIRRIGATED

This unit consists of deep, nearly level soils that have a loam, silt loam, or clay loam surface layer. In most of these soils the subsoil is heavy clay loam or light clay, but in some it is silt loam or silty clay loam.

These soils can be cultivated, but they are highly erodible where not protected by vegetation or plant residue. These soils are easily tilled and have a high available water capacity. They take in water at a moderate rate, except during periods of drought when the surface layer is loose and dry, and then they take in water at a very slow rate and have moderately rapid surface runoff. Soil blowing is the major management problem, particularly during drought.

These soils are extensive. They amount to over 40 percent of the total acreage in the county, and they are almost entirely under cultivation. Wheat, grain sorghum, and forage sorghum are the primary crops. Summer fallowing is used to store moisture for crops. Stubble mulching and stripcropping help to control soil blowing and conserve moisture. On some fields, contour furrowing and terraces are used to prevent surface runoff. Chiseling and listing are emergency tillage practices that help control soil blowing.

Where these soils are in native grass, blue grama and buffalograss are most abundant. Deferred grazing and reseeding help improve range.

CAPABILITY UNIT IVe-2, NONIRRIGATED

This unit consists of deep, gently sloping and undulating soils that commonly occur as small, elongated areas adjacent to drainageways on uplands. These soils have a loam and clay loam surface layer and a silty clay loam or clay loam subsoil.

They are easily tilled and have high available moisture capacity. The rate of water intake is moderate, but during a heavy rain, much of the water runs off.

About half of the acreage is cultivated, primarily to wheat. Practices such as stubble mulching, contour furrowing, and stripcropping help control surface runoff and soil blowing and conserve moisture. Areas that are not protected erode readily.

Where these soils are in native grass, buffalograss and blue grama are most abundant. Soil blowing and surface runoff are seldom problems where a grass cover is maintained. A few grassed areas have been contour furrowed to help reduce surface runoff.

CAPABILITY UNIT IVe-3, NONIRRIGATED

This unit consists of deep, nearly level soils that have a surface layer and subsoil of sandy loam.

These soils are easily tilled and take in water at a rapid rate. They have moderate available water capacity and moderate natural fertility. They are easily blown when not protected by vegetation or crop residue.

Grain and forage sorghums and broomcorn are the most suitable crops. Wheat can be grown, but practices such as stripcropping and stubble mulching are necessary to control soil blowing. Intensive crop residue management is necessary.

More than half the acreage of these soils is in native vegetation. Both tall and short grasses grow in a mixed stand where careful grazing management is practiced. Where grazing is heavy, few of the tall grasses remain.

CAPABILITY UNIT IVe-4, NONIRRIGATED

This unit consists of nearly level soils that have a loamy sand surface layer and a sandy loam or sandy clay loam subsoil. The surface layer has such a high content of sand that it is noncoherent and loose.

These soils take in water rapidly, and little moisture is lost through surface runoff. The surface layer has a low available water capacity, but the subsoil has a moderate to high available water capacity. The surface layer blows easily if not protected by a crop or crop residue.

Broomcorn and grain sorghums are the most suitable crops because they grow well and their tall stubble protects the soil during the winter and spring. Forage sorghums grow well and give adequate soil protection if the stubble is at least 14 inches high after harvest. Wheat is sometimes grown, but it is not considered a good crop. Summer fallowing is not a good practice because the gain in water storage is not sufficient to affect the hazard of soil blowing.

Short, mid, and tall grasses in mixed stands are common native vegetation where this soil is used as rangeland. Where the vegetative cover is overgrazed, the tall grasses, except for sand dropseed and weeds, have decreased and the short grasses have increased.

CAPABILITY UNIT VIe-1, NONIRRIGATED

This unit consists of moderately deep and deep, light-colored, gently sloping to strongly sloping loams or silt loams.

These soils have a moderate to high available water capacity. Where they have good grass cover, these soils take in water at a medium rate. Where they are cultivated, a crust forms on the surface and much of the water runs off.

Nearly 30 percent of the acreage of these soils is cultivated. Wheat and sorghum are the main crops. Stubble mulching, stripcropping, and contour furrowing help reduce soil blowing and water erosion, but average crop yields are low and crop failures are frequent.

These soils are best suited to pasture or range. Blue grama is the common native grass, and the wheatgrasses and Russian wildrye are suitable pasture grasses. When properly used, blue grama has a bunchy and thrifty appearance and produces some seed stalks annually. Deferred and rotation grazing, reseeding, and contour furrowing are common practices on range.

CAPABILITY UNIT VIe-2, NONIRRIGATED

This unit consists of Thedalund silty clay loam, a moderately sloping to strongly sloping, calcareous soil on uplands. It ranges from 20 to 40 inches in thickness and is underlain by shale. This soil takes in water slowly. Much of the annual precipitation is lost through surface runoff.

All the acreage of this soil is in native vegetation. Alkali sacaton, blue grama, and galletagrass are abundant and grow especially well in years of normal or high precipitation.

Contour furrowing helps retard runoff and increase vegetation. Deferred and rotation grazing improve or maintain the vegetative cover.

CAPABILITY UNIT VIe-3, NONIRRIGATED

This unit consists of deep, nearly level to moderately steep, calcareous soils that are dominantly loamy sands and sandy loams.

These soils take in water rapidly, but have moderate available water capacity. Only a small percentage of the annual precipitation is lost from runoff.

About 10 percent of the acreage of these soils is cultivated. Proper residue management, contour furrowing, and stripcropping help control soil blowing, but average crop yields are low and frequent crop failures can be expected.

This unit is best suited to pasture or range. The native vegetation is a mixture of tall, mid, and short grasses where the range is well managed. Sand lovegrass and sweet clover are suitable pasture grasses. Deferred and rotation grazing help maintain adequate range cover. Under severe use, the tall and mid grasses nearly disappear, and sand sage and yucca increase. Where these soils are reseeded, a protective cover of plant residue or growing vegetation is necessary.

CAPABILITY UNIT VIe-4, NONIRRIGATED

This unit consists of Tivoli sand, a deep, excessively drained, gently sloping to steep soil.

This soil takes in water rapidly, but has a low available water capacity.

Nearly all of the acreage of this soil is in native vegetation. Tall and mid grasses are common where proper grazing is maintained and the precipitation is adequate. Deferred and rotation grazing help control soil blowing. Where the cover is overgrazed, sand sage and other invaders increase.

Small areas of this soil are blown out. These areas are difficult to revegetate because of the unstable soil condition. If the eroded areas are to be reseeded, a cover crop of sorghum or grain stubble is necessary.

CAPABILITY UNIT VIIe-1, NONIRRIGATED

This unit consists of the Tivoli-Dune land complex, which is deep, droughty, nearly level to moderately steep sands. Water intake is rapid, and available water capacity is low.

Part of this complex is blowouts that have little or no vegetation. The vegetation in these areas is mainly blowoutgrass and three-awn. To reestablish vegetation in the blowouts, blowing must be controlled. Deferred grazing is necessary, and if possible, revegetated areas should be fenced. Part of this unit is vegetated, mainly with sand sage and tall grasses.

CAPABILITY UNIT VIIw-1, NONIRRIGATED

This unit consists of Bankard sand, a deep, nearly level soil. This soil takes in water rapidly and has a low available water capacity. It is subject to frequent overflows.

This soil is used only for range. The vegetation is varied, and includes cottonwood trees, tamarisk, sand sage, and several kinds of grasses. Maintaining vegetative cover and preventing erosion are the major management problems.

CAPABILITY UNIT VIIs-1, NONIRRIGATED

This unit consists of Apache stony loam, a shallow, steep soil. This soil takes in water at a medium rate, but because of steep slopes, it loses a high percentage of the annual precipitation through surface runoff.

This soil is not cultivated, but is used for range. Deferred and rotation grazing help maintain the vegetative cover, which is primarily big bluestem, side-oats grama, and spike muhly. Where the cover is overgrazed, blue grama, buffalograss, and other short grasses increase.

CAPABILITY UNIT VIIs-2, NONIRRIGATED

This unit consists of shallow, gently sloping to steep soils. These soils take in water at a medium rate, but have a low available water capacity. Because of the high rate of runoff, a high percentage of the annual precipitation is lost.

These soils are used for grazing. Little bluestem, side-oats grama, and tall dropseed are the common grasses. Deferred and rotation grazing help maintain a cover of tall and mid grasses. Where the cover is overgrazed, blue grama increases.

CAPABILITY UNIT VIIs-3, NONIRRIGATED

This unit consists of Penrose channery loam, a nearly level to steep soil. This soil takes in water at a medium rate, but because it is shallow, it has a low available water capacity.

All of the acreage of this soil is in native vegetation. The main grasses are side-oats grama, little bluestem, Indian ricegrass and blue grama. Proper range practices, such as deferred and rotation grazing, help maintain vegetative cover. Where the cover is overgrazed, snakeweed increases.

CAPABILITY UNIT VIIs-4, NONIRRIGATED

This unit consists of gently sloping to steep sands. These soils take in water at a medium rate, but because they are shallow, they have a low available water capacity.

All of these soils are in native vegetation. The common grasses are big and little bluestem and side-oats grama. Deferred and rotation grazing help maintain the vegetative cover. Where the cover is overgrazed, tall grasses decrease and short grasses and invaders increase.

CAPABILITY UNIT VIIIe-1, NONIRRIGATED

This unit consists of Dune land, a deep, excessively drained, loose coarse sand. It takes in water at a rapid rate and has almost no surface runoff.

This land type does not have enough vegetation to protect it from soil blowing. Blowoutgrass and three-awn are the main grasses.

To improve this land, it is necessary to prevent soil blowing by placing tree limbs, old tires, straw, or some other type of residue on the surface. Sorghum is then planted, and later, grasses can be introduced.

Sand blown from this land damages crops on adjacent fields.

Predicted yields

Predicted yields of the principal nonirrigated crops grown in Baca County are given in table 2, and predicted yields of the principal irrigated crops in table 3. The yields given in tables 2 and 3 are for two levels of management. Those in columns A were obtained under the

level of management followed by most farmers in the county. Those in columns B were obtained under a high level of management.

The predicted yields in both tables are based on records of the Agricultural Research Service; on statistics of the Colorado Crop and Livestock Reporting Service; on observations made in the field; and on discussions with farmers and with members of the staff of Colorado State University.

Table 2 gives the predicted yields of principal nonirrigated crops. Yields in columns A are obtained under the prevailing management that consists of (1) tilling and other fieldwork done either around-and-around the field or parallel to boundary lines and (2) using a one-way disk plow for tillage so that only a small amount of stubble is left to protect the soils during summer fallow. Yields in columns B are obtained under a high level of management that consists of (1) contour farming on slopes of more than 1 percent; (2) stripcropping of sandy loams and loamy sands; (3) maintaining as good a cover of stubble as possible during the period of summer fallow; and (4) planting a crop only when the content of soil moisture is favorable.

Table 3 gives the predicted yields of the principal irrigated crops. Yields in columns A are obtained under the prevailing management that consists of (1) using a limited amount of fertilizer for all crops except sugar beets; and (2) seldom plowing under green-manure crops. Because most of the soils have been irrigated only recently, management techniques are just developing and the system of irrigation needs improvement. Yields in columns B are obtained under a high level of management that consists of (1) maintaining fertility and content of organic matter by applying barnyard manure and commercial fertilizer and by plowing under green-manure crops; (2) improving management of irrigation water; (3) following a good crop rotation; (4) controlling weeds and insects; and (5) controlling the hazard of erosion by use of the best conservation practices for the kind of soil.

The yields in tables 2 and 3 should be used only as a guide to comparing one soil with another and to noting how improved management may increase production. Yield figures represent an average of years of high and low precipitation. Yields in some very favorable years may be double those given.

TABLE 2.—*Predicted crop yields for Baca County on nonirrigated cropland*

[Soils listed are those on which significant yields of one or more of the principal crops are obtained. The figures in columns A are average yields under common management, and in columns B, yields under improved management. Dashed lines indicate crop is not commonly grown on the soil at the level of management specified. Wheat yields are based on a system of summer fallow]

Soil	Wheat		Sorghum		Broomcorn	
	A	B	A	B	A	B
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Lbs.*	*Lbs.*
Baca clay loam, 0 to 1 percent slopes	11	13	12	15	------	------
Baca clay loam, 1 to 3 percent slopes	10	13	11	15	------	------
Baca clay loam, 3 to 5 percent slopes	8	10	8	11	------	------
Campo clay loam	12	14	11	14	------	------
Capulin loam	------	------	------	------	------	------
Colby silt loam, 0 to 1 percent slopes	10	13	9	12	------	------
Colby silt loam, 1 to 3 percent slopes	9	12	9	12	------	------
Colby silt loam, terrace, 0 to 2 percent slopes	10	13	9	12	------	------
Dalhart loamy sand, 0 to 1 percent slopes	(1)	------	(1)	------	275	450
Dalhart loamy sand, 1 to 3 percent slopes	(1)	------	(1)	------	275	450
Dalhart sandy loam, 0 to 1 percent slopes	14	17	16	20	300	500
Dalhart sandy loam, 1 to 3 percent slopes	14	17	16	20	300	500
Glenberg sandy loam	10	12	13	15	------	------
Goshen loam, 0 to 1 percent slopes	17	20	16	21	------	------
Goshen loam, 1 to 3 percent slopes	15	18	16	21	------	------
Harbord loam, 0 to 1 percent slopes	11	13	11	15	------	------
Harbord loam, 1 to 3 percent slopes	10	13	11	15	------	------
Harbord loam, 3 to 5 percent slopes	8	10	8	11	------	------
Manter and Vona sandy loams, 0 to 1 percent slopes	12	14	13	15	250	400
Manter and Vona sandy loams, 1 to 3 percent slopes	12	14	13	15	250	400
McCook loam, 0 to 1 percent slopes	14	16	12	15	------	------
McCook loam, 1 to 3 percent slopes	13	16	11	15	------	------
Nunn clay loam	------	------	------	------	------	------
Otero sandy loam, 0 to 3 percent slopes	7	9	9	12	200	350
Richfield silt loam, 0 to 1 percent slopes	17	20	15	20	------	------
Ulysses and Norka silt loams, 0 to 1 percent slopes	15	18	14	18	------	------
Ulysses and Norka silt loams, 1 to 3 percent slopes	15	18	13	18	------	------
Vona loamy sand, 0 to 3 percent slopes	(1)	------	(1)	------	200	350
Wages loam	12	15	11	15	------	------
Wiley loam, 0 to 1 percent slopes	11	14	11	14	------	------
Wiley loam, 1 to 3 percent slopes	11	14	10	13	------	------
Wiley loam, 3 to 5 percent slopes	8	10	8	10	------	------
Wiley soils, eroded	8	10	7	10	------	------

[1] This soil is not summer fallowed.

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Table 3.—*Yields of principal irrigated crops*

[Only irrigated soils are shown on this table. Figures in columns A are for average acre yields under common management; those in columns B are for average yields under a high level of management. Dashes show the crop is not grown on the soil at the level of management specified]

Soil	Wheat		Alfalfa		Beets		Grain Sorghum	
	A	B	A	B	A	B	A	B
	Bu.	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*
Baca clay loam, 0 to 1 percent slopes	35	44	2.5	5.5	14	20	48	37
Baca clay loam, 1 to 3 percent slopes	29	37	2.2	5.0	13	18	44	53
Baca clay loam, 3 to 5 percent slopes	24	30	1.5	4.0	------	------	37	44
Campo clay loam	35	42	2.5	5.0	13	19	48	57
Colby silt loam, 0 to 1 percent slopes	34	43	2.4	5.5	14	20	45	54
Colby silt loam, 1 to 3 percent slopes	28	36	2.2	5.0	13	18	41	49
Colby silt loam, terrace, 0 to 2 percent slopes	30	38	2.2	5.0	13	18	45	54
Dalhart loamy sand, 0 to 1 percent slopes	24	34	2.0	5.0	------	------	38	48
Dalhart loamy sand, 1 to 3 percent slopes	22	32	1.9	4.5	------	------	34	43
Dalhart sandy loam, 0 to 1 percent slopes	32	40	2.2	5.5	13	19	50	62
Dalhart sandy loam, 1 to 3 percent slopes	29	37	2.0	5.0	12	17	46	57
Glenberg sandy loam	26	34	2.0	5.0	10	17	42	52
Goshen loam, 0 to 1 percent slopes	36	45	3.0	6.0	16	22	54	65
Goshen loam, 1 to 3 percent slopes	33	41	2.5	5.0	14	20	50	60
Harbord loam, 0 to 1 percent slopes	35	44	2.5	5.0	14	20	48	58
Harbord loam, 1 to 3 percent slopes	29	37	2.2	4.8	13	18	44	53
Harbord loam, 3 to 5 percent slopes	24	30	1.5	4.0	------	------	37	44
Manter and Vona sandy loams, 0 to 1 percent slopes	26	36	2.2	5.0	10	15	45	56
Manter and Vona sandy loams, 1 to 3 percent slopes	24	33	2.0	4.8	10	15	41	51
McCook loam, 0 to 1 percent slopes	36	45	2.5	6.0	------	------	48	57
McCook loam, 1 to 3 percent slopes	32	40	2.2	5.0	------	------	44	53
Nunn clay loam	35	42	2.5	5.0	13	19	48	57
Otero sandy loam, 0 to 3 percent slopes	22	30	2.0	4.5	------	------	40	50
Richfield silt loam, 0 to 1 percent slopes	38	47	3.0	6.0	16	22	55	66
Ulysses and Norka silt loams, 0 to 1 percent slopes	37	46	3.0	6.0	15	21	50	60
Ulysses and Norka silt loams, 1 to 3 percent slopes	33	41	2.5	5.0	15	21	46	55
Vona loamy sand, 0 to 3 percent slopes	------	------	1.5	4.0	------	------	35	44
Wages loam	28	36	2.5	5.0	14	20	40	48
Wiley loam, 0 to 1 percent slopes	34	43	2.5	5.5	14	20	45	54
Wiley loam, 1 to 3 percent slopes	29	37	2.4	5.0	13	18	41	49
Wiley loam, 3 to 5 percent slopes	24	30	2.2	4.0	------	------	34	41

Management of Soils for Range[3]

Range makes up about 50 percent of the agricultural land in Baca County, and raising livestock is a major enterprise. Cows and calves are the main livestock. Some calves are held over as winter stockers. The chief crops used for supplemental feeding are winter wheat, forage sorghums, grain sorghums, sudangrass, and broomcorn aftermath.

The native range in most parts of this county is a mixture of mid and short grasses on the hardlands and of mid and tall grasses on the sandy soils (*3*). Blue grama and buffalograss are dominant on the hardlands. Side-oats grama, blue grama, yellow indiangrass, and sand dropseed are dominant on the sandy soils.

In the rough, broken areas, blue grama and side-oats grama are dominant. Juniper trees grow on some of the rough, broken land, and sand sage and yucca are prominent on the sandy soils. Cactus, snakeweed, and yucca occur on the hardlands.

The climate of the county markedly influences growth of forage plants (fig. 9). Rainfall is erratic, and most of it comes during summer. Many of the rains either are of high intensity and result in excessive runoff or they come as ineffective showers. Dry spells are common in midsummer. Hot, dry winds cause excessive evaporation and transpiration, which further reduces the beneficial effect of any precipitation that falls. Most of the growth is made by native grasses between April and August. Frequently growth is retarded or stopped by lack of moisture early in the growing season.

Range sites and range condition

The main objective of good range management is to obtain maximum use of available forage without causing a decrease in the amount or vigor of the desired species. If this is done, water is conserved, yields are maintained, and the soils are protected.

To facilitate good management, the soils of Baca County have been placed in range sites. A range site is a group of soils capable of producing about the same kind and amount of forage. On a given range site, the potential plant community (or the original vegetation) is considered to be the most productive combination of plants that will maintain itself under range conditions. This potential plant community will remain unchanged as long as the environment remains unchanged.

[3] Ed C. Dennis, range conservationist, Soil Conservation Service, assisted with this section.

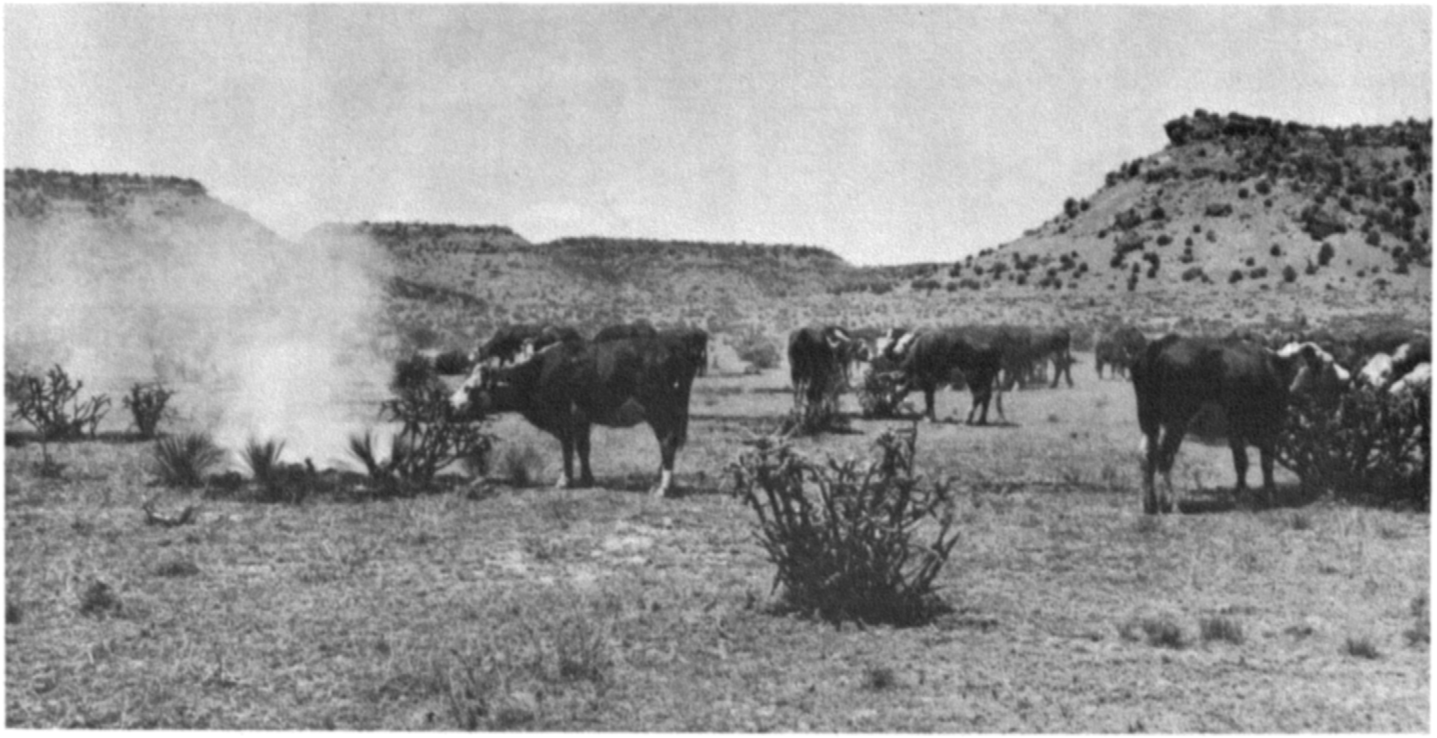

Figure 9.—**In extremely dry years ranchers burn the spines from cholla cactus, which then provides supplemental feed for livestock. This soil is Nunn clay loam.**

Under continued heavy grazing, however, the condition of a range site deteriorates. The changes take place gradually and in the early stages are not easily recognized.

Changes in range condition are determined by comparing the present vegetation with the potential plant community (original vegetation) for the range site. The condition is estimated by observing the proportion of *decreaser*, *increaser*, and *invader* plants on the range site. Decreaser plants are usually perennials and are the plants more palatable to livestock. They are generally the dominant plants in the potential plant community. They decrease in relative abundance under continued moderately heavy to heavy grazing, and they are replaced by increaser plants. Increasers are often the shorter, less productive, subdominant members of the potential vegetation. Their forage value ranges from high to low, and those with low forage value tend to increase most under heavy grazing.

If moderately heavy to heavy grazing continues, even the increaser plants decline and are replaced by invaders. The invaders are less desirable grasses and weeds that were not members of the potential plant community on the range site, but that are members of the plant community in other range sites in the same general locality. Many invaders are woody plants or herbaceous perennials and annuals that are introduced from other lands.

Four range condition classes indicate degree of departure from the native potential plant community: *excellent*, *good*, *fair*, and *poor*. On range in excellent condition, 76 to 100 percent of the plant cover consists of plants in the potential plant community. Range in good condition has a plant cover in which 51 to 75 percent of the vegetation is that originally on the site. On range in fair condition, 26 to 50 percent of the vegetation is that originally on the site; and on range in poor condition, not more than 25 percent of the original plant community remains.

In Baca County about 70 percent of the rangeland is in only fair condition. In many areas, overgrazing is evidenced by absence of grasses that decrease under heavy grazing and by productivity below that of excellent condition.

Descriptions of range sites

Described in the following pages are the 11 range sites in Baca County. For each site, the composition of the original vegetation is given, and the principal invaders are listed. Production is estimated in terms of total annual yield of air-dry plant materials per acre. Yields are in pounds per acre for all plants growing on the site, and in pounds of forage that cattle will eat. These yields were obtained by field observation and by clipping and weighing the vegetation from representative plots.

LOAMY PLAINS RANGE SITE

Soils of this range site make up about half of the total rangeland in Baca County. These soils are nearly level to sloping, deep to moderately deep, loamy, and well drained. Their water intake rate is moderate to moderately slow, but they have good available water capacity. On overgrazed range, runoff is rapid and the soils are eroded by both wind and water.

In the potential plant community, blue grama and buffalograss make up as much as three-fourths of the plant cover. Growing with these two increasers are

western wheatgrass, side-oats grama, needlegrass, Indian ricegrass, and winterfat. Small amounts of three-awn, sand dropseed, wild alfalfa, pricklypear, snakeweed, ring muhly, and rabbitbrush are present. Overgrazing on this site causes a reduction of decreaser plants and lowers the production of blue grama. Buffalograss increases and forms a dense sod.

At optimum plant density 35 percent of the ground is covered. A higher density tends to increase runoff and to reduce production. Density below 25 percent also reduces production and increases the hazard of erosion.

The estimated annual yield of air-dry plant material is 800 to 1,220 pounds per acre. About 90 percent of this provides forage for cattle.

SANDY PLAINS RANGE SITE

Soils of this site make up about one-third of the total rangeland in Baca County. These are deep, nearly level to gently undulating, moderately sandy soils on uplands. The largest area occurs in the southeastern corner of the county. These soils have moderately rapid water intake and high available water capacity. They readily absorb water from light showers and release the moisture to plants. Where the soil is overgrazed, soil blowing is the most serious hazard.

This is one of the most favorable range sites for grazing in the county. Blue grama and sand dropseed make up about 40 percent of the potential plant community, and on areas with higher rainfall, a mixture of tall, mid, and short grasses makes up about 30 percent of the plant community. Side-oats grama, needle-and-thread, sandreed, sand bluestem, little bluestem, and western wheatgrass make up about 20 percent of the stand, and Indian ricegrass, sedge, sand sage, yucca, buckwheat, and sand dropseed make up about 10 percent. Overgrazing on this site causes an increase of yucca, sand sage, and sand dropseed. At optimum plant density, 40 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 1,200 to 2,500 pounds per acre. About 85 percent of this provides forage for cattle.

DEEP SAND RANGE SITE

Soils of this site make up about 2 percent of the total rangeland in Baca County. These soils are deep, gently undulating, excessively drained loamy sands and sands. They are rapidly permeable and have low available water capacity. Soil blowing is a severe hazard.

The soils on this range site favor deep-rooted grasses. Sand reedgrass, sand bluestem, and big bluestem make up about 50 percent of the potential plant community. Less abundant plants are needle-and-thread, side-oats grama, little bluestem, switchgrass, and yellow indiangrass. Blue grama, sand dropseed, and forbs and shrubs, such as sand sage and yucca, make up no more than one-third of the stand. At optimum plant density, 30 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 1,200 to 2,000 pounds per acre. About 75 percent of this provides forage for cattle.

CHOPPY SAND RANGE SITE

Soils of this site make up less than 2 percent of the total rangeland in Baca County. These soils are loose, unstable sands that have rapid water intake and deep percolation.

The vegetation on this soil responds to moisture quickly, and in years of above-normal precipitation, these soils produce good stands of grass. The potential plant community consists of sand bluestem, sandreed, blowoutgrass, sandhill muhly, and switchgrass. Three-awn, sand sage, yucca, and lemon scurfpea occur in smaller amounts, but when the range is overgrazed, they increase. At optimum plant density, 25 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 600 to 1,200 pounds per acre. About 70 percent of this provides forage for cattle.

SHALY PLAINS RANGE SITE

Soils of this site make up less than 1 percent of the total rangeland in Baca County. These soils are moderately deep to deep, moderately steep, and moderately fine textured. They are alkaline and have a high percentage of gypsum in the soil profile. These soils have a severe hazard of water erosion, and where they are without vegetation, they erode rapidly. They are extremely difficult to revegetate.

Alkali sacaton and blue grama make up most of the potential plant community. Galletagrass makes up about one-fourth of the plant cover, and forbs, browse, woody aster, pricklypear, rabbitbrush, and squirreltail occur in very small amounts. At optimum plant density, 30 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 700 to 1,100 pounds per acre. About 85 percent of this provides forage for cattle.

SANDY BOTTOMLAND RANGE SITE

Soils of this site make up less than 1 percent of the total rangeland in Baca County. These soils are excessively drained sandy loams. They occur primarily on nearly level stream terraces and are subject to occasional overflow.

The potential plant community is dominantly tall grasses, such as switchgrass, indiangrass, and bluestem, and smaller amounts of mid grasses and other plants. Most areas are in poor condition and are dominated by sand dropseed or saltgrass. At optimum plant density, 40 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 1,500 to 2,000 pounds per acre. About 80 percent of this provides forage for cattle.

BASALT LOAM RANGE SITE

Soils of this site make up less than 1 percent of the total rangeland in Baca County. These soils are nearly level to gently undulating loams that developed in material weathered from basalt.

These soils are moderately permeable. Because the underlying basalt is fractured, moisture concentrates in cracks and moisture and roots can penetrate deeply through the cracks. Small areas of shallow soil and exposed rock concentrate and shed water from light showers. This increases soil moisture content and favors the growth of mid grasses.

Western wheatgrass, side-oats grama, big bluestem, little bluestem, and spike muhly make up about two-thirds of the potential plant community. Blue grama

makes up about one-third of the stand and increases when the range is overgrazed. Snakeweed, ring muhly, and Texas tumblegrass occur in small amounts. At optimum plant density, 40 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 1,000 to 1,500 pounds per acre. About 85 percent of this provides forage for cattle.

BASALT BREAKS RANGE SITE

Soils of this site make up less than 1 percent of the total rangeland in Baca County. These soils are shallow loams. In many places, basalt boulders are on the surface. Plant growth is confined to soil areas between the boulders.

The potential plant community consists of tall and mid grasses, such as big bluestem, little bluestem, yellow indiangrass, side-oats grama, and spike muhly. Shrubs common on this site are mountain mahogany, wild rose, poison ivy, hopbush, skunkbush, and wolfberry. Trees, which are not abundant, are one-seeded juniper, Rocky Mountain juniper, and on some north-facing slopes, pinyon and ponderosa pine. Blue grama, buffalograss, and oakbrush increase as grazing pressure increases. At optimum plant density, 25 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 1,200 to 2,000 pounds per acre. About 70 percent of this provides forage for cattle.

SANDSTONE BREAKS RANGE SITE

Soils of this site make up about 6 percent of the total rangeland in Baca County, and occur mostly in the southwestern corner of the county. These soils are steep, shallow, stony sandy loams that developed from sandstone and interbedded shale. The water intake rate is moderate to rapid, and because slopes are steep, the hazard of water erosion is severe.

Side-oats grama, little bluestem, big bluestem, yellow indiangrass, spike muhly, and black grama make up the potential plant community. Blue grama, sand dropseed, yucca, skunkbush, buckwheat, and juniper occur in lesser amounts, with blue grama and juniper increasing under heavy grazing pressure. At optimum plant density, 30 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 600 to 1,200 pounds per acre. About 70 percent of this provides forage for cattle.

LIMESTONE BREAKS RANGE SITE

Soils of this site make up less than 1 percent of the total rangeland in Baca County. These soils are sloping, very shallow channery loams that overlie limestone. The rate of surface runoff is medium to rapid, and the hazard of water erosion is severe. There is very little soil material for water retention and plant development.

The potential plant community is side-oats grama, little bluestem, New Mexico needlegrass, Indian ricegrass, and blue grama. Cedar trees and bigelow sage are present, along with numerous cushion plants such as nailwort, low phlox, mat loco, and snakeweed. As grazing pressures increase, juniper, bigelow sage, and the cushion plants increase. At optimum plant density, 25 percent of the ground is covered.

The estimated annual yield of air-dry plant material is 300 to 800 pounds per acre. About 75 percent of this provides forage for cattle.

GRAVEL BREAKS RANGE SITE

Soils of this site make up about 3 percent of the total rangeland in Baca County. They occur as narrow strips along Two Buttes, Horse, Bear, and Cat Creeks. These soils are shallow, sloping, excessively drained, and gravelly and cobbly. They have low available water capacity and, because of the steepness of the slopes, a severe hazard of water erosion.

The potential plant community consists of little bluestem, side-oats grama, western wheatgrass, and tall dropseed. Shrubs such as skunkbush, yucca, wild rose, and leadplant are present. As grazing pressure increases, blue grama increases. At optimum plant density, 25 percent of the gravel is covered.

The estimated annual yield of air-dry plant material is 1,000 to 1,500 pounds per acre. About 80 percent of it provides forage for cattle.

Management of Soils for Windbreaks [4]

Few trees are native to Baca County. Native juniper and cedar trees grow on the shallow soils in the western part of the county, and a few cottonwood, willow, shrub oak, and elm trees grow on deeper soils along drainageways where extra water is available. These trees have little economic value, but they do help prevent erosion when used as windbreaks and offer protection to wildlife and livestock.

Nearly all the soils in this county can support trees if supplemental water is furnished. Because of the low rainfall, windbreak plantings are most feasible in areas where it is possible to divert extra water to them.

Windbreaks should consist of at least three rows of trees and shrubs. The shrubs should be planted on the windward side to keep the wind from sweeping under the trees. Evergreens should be used in all windbreaks. Generally, evergreens live longer and provide better protection throughout the year than other trees.

Where it is possible to irrigate the windbreaks regularly, trees can be planted closer together and a greater choice of trees is available. Trees require little watering once they are established (fig. 10). Farmstead windbreaks require soils that have favorable moisture content.

Suitable trees for nonirrigated areas are Chinese elm, hackberry, Russian-olive, ponderosa pine, Austrian pine, Rocky Mountain juniper, and eastern redcedar. Trees suitable for irrigated areas are Chinese elm, greenash, crack willow, yellow willow, American elm, hackberry, ponderosa pine, Austrian pine, blue spruce, white fir, lodgepole pine, Rocky Mountain juniper, and eastern redcedar. Squawbush grows well on all the soils, and sand cherry grows well on the sandy soils. Shrubs that grow well under irrigation are squawbush, honeysuckle, cotoneaster, lilac, chokecherry, buffaloberry, and American plum.

The soils in Baca County that are suited to windbreaks have been placed into the loamy or the sandy windbreak

[4] W. S. SWENSON, woodland conservationist, Soil Conservation Service, helped prepare this section.

Figure 10.—**Windbreak on Colby silt loam, 1 to 3 percent slopes.**

group. To determine which soils have been assigned to a windbreak group, refer to the "Guide to Mapping Units" at the back of the survey. Soils and land types that are not suited to windbreaks are shallow, clayey or very sandy, and generally steep. Establishing trees is difficult, and few trees survive. Where planted, trees require intensive management.

LOAMY WINDBREAK GROUP

The soils in this group are moderately deep to deep, nearly level to moderately steep silt loams, loams, or clay loams.

If trees can be established on these soils, they grow satisfactorily. Blowing soil and drought are the chief hazards to the young trees. Summer-fallowing the season before planting and clean cultivation help in establishing trees. At planting time and for the first two or three years of growth, the trees should be watered.

SANDY WINDBREAK GROUP

The soils in this suitability group are sandy loams or loamy sands that have slopes of 0 to 9 percent. The hazard of soil blowing is high, and intensive care is necessary to protect young trees from blowing sand. Because the surface layer has low available water capacity, providing water for young trees is more critical on these soils than on the loamy soils.

Where planting a windbreak, strips of growing vegetation or stubble between rows is desirable. Vegetation between the rows collects snow and controls runoff. Growing permanent vegetation in a band a quarter mile wide along the windward side of a new windbreak helps protect young trees from blowing sand. Placing snow fences along the windbreak also helps protect young trees.

Management of Soils for Wildlife [5]

The extensive grasslands of Baca County once supported large herds of pronghorn antelope, large herds of bison, flocks of prairie chickens, and other animals. After the county was settled, changes in land use altered the wildlife habitat. The changes have been unfavorable to some kinds of wildlife and favorable to other kinds and have made possible the introduction of new species. For example, where the range was overgrazed and the tall grasses were replaced by short grasses, the habitat of the prairie chicken was eliminated (*4*). At the same time, planting the grasslands to grain created habitat for mourning doves and Canada geese.

Table 4 indicates the suitability of each of the seven

[5] Prepared by ELDIE W. MUSTARD, state biologist, Soil Conservation Service.

soil associations to provide habitat for specified kinds of wildlife. The ratings indicate potential for wildlife, not necessarily present use. The general soil map at the back of this survey shows the location of the seven soil associations in the county.

In Baca county, irrigation makes possible relatively sustained production of cover and food that are otherwise sparse. The ring-necked pheasant has been successfully introduced, particularly in the Richfield-Ulysses-Norka association, the Baca-Wiley association, and the Vona-Manter-Dalhart association. This was possible because small grain and cover are produced year after year on soils that are irrigated. The pheasant population is limited, however, in intensively cultivated areas because there is little area left undisturbed to serve as nesting cover.

Antelope share the rangeland with cattle, particularly in the Vona-Manter-Dalhart association, the Wiley-Potter association, and the Minnequa-Manvel-Penrose association. The potential for antelope is good if range management is good. On overgrazed range, competition between cattle and antelope for food can be serious. On properly managed range, there is little competition. The antelope commonly eat forbs, even cacti, and browse on

TABLE 4.—*Suitability of soil associations for wildlife habitat*

Soil associations	Wildlife	Suitability for—				
		Protective and escape cover		Food	Aquatic environment	
		Woody	Herbaceous		Natural	Developed
1. Richfield-Ulysses-Norka.	Pheasants	Fair	Good	Good	Not applicable	Not applicable.
	Mourning dove	Fair	Not applicable	Good	Not applicable	Not applicable.
	Cottontail	Fair	Good	Good	Not applicalbe	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Waterfowl	Not applicable	Not applicable	Good	Not applicable	Good.
	Fish	Not applicable	Not applicable	Good	Not applicable	Good.
2. Baca-Wiley.	Pheasants	Fair	Good	Good	Not applicable	Not applicable.
	Mourning dove	Fair	Not applicable	Good	Not applicable	Not applicable.
	Cottontail	Fair	Good	Good	Not applicable	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Waterfowl	Not applicable	Not applicable	Good	Not applicable	Good.
	Fish	Not applicable	Not applicable	Good	Not applicable	Good.
3. Vona-Manter-Dalhart.	Pheasants	Fair	Fair	Good	Not applicable	Not applicable.
	Mourning dove	Fair	Not applicable	Good	Not applicable	Not applicable.
	Scaled quail	Fair	Good	Good	Not applicable	Not applicable.
	Cottontail	Fair	Fair	Good	Not applicable	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Antelope	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Waterfowl	Not applicable	Not applicable	Good	Not applicable	Fair.
	Fish	Not applicable	Not applicable	Not applicable	Not applicable	Poor.
4. Travessilla-Kim.	Mourning dove	Good	Not applicable	Fair	Not applicable	Not applicable.
	Scaled quail	Good	Good	Good	Not applicable	Not applicable.
	Cottontail	Good	Fair	Good	Not applicable	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Deer	Good	Not applicable	Fair	Not applicable	Not applicable.
	Turkey	Good	Not applicable	Good	Not applicable	Not applicable.
	Fish	Not applicable	Not applicable	Not applicable	Not applicable	Fair.
5. Wiley-Potter.	Mourning dove	Not applicable	Not applicable	Poor	Not applicable	Not applicable.
	Scaled quail	Not applicable	Fair	Fair	Not applicable	Not applicable.
	Cottontail	Not applicable	Poor	Fair	Not applicable	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Fair	Not applicable	Not applicable.
	Waterfowl	Not applicable	Not applicable	Not applicable	Not applicable	Good.
	Fish	Not applicable	Not applicable	Not applicable	Not applicable	Good.
6. Minnequa-Manvel-Penrose.	Mourning dove	Not applicable	Not applicable	Poor	Not applicable	Not applicable.
	Scaled quail	Not applicable	Poor	Fair	Not applicable	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Fair	Not applicable	Not applicable.
	Antelope	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Fish	Not applicable	Not applicable	Not applicable	Not applicable	Poor
7. Otero-Potter.	Mourning dove	Not applicable	Not applicable	Fair	Not applicable	Not applicable.
	Scaled quail	Not applicable	Good	Good	Not applicable	Not applicable.
	Cottontail	Not applicable	Good	Fair	Not applicable	Not applicable.
	Jackrabbit	Not applicable	Not applicable	Good	Not applicable	Not applicable.
	Antelope	Not applicable	Not applicable	Good	Not applicable	Not applicable.

shrub plants that cattle do not commonly eat unless forced to do so because of overgrazing (*5*). In most of Baca County, the potential for antelope may never be realized because of overuse of the range by livestock and frequent drought. An exception is the Comanche National Grasslands administered by the U.S. Forest Service. This area, located primarily in the Minnequa-Manvel-Penrose association, offers a high potential for development of antelope herds.

Some mule deer live in the Travessilla-Kim association, but because recurring drought limits the production of browse plants, the potential for deer is limited.

Scaled quail thrive on grassland in the Minnequa-Manvel-Penrose association and the Travessilla-Kim association. Quail are very adaptable and utilize such things as abandoned cars and farmsteads for cover. Brush piled near the area of stock-watering facilities is beneficial to quail.

Turkey are native to parts of Baca County, and in the early 1950's, the Colorado Game, Fish, and Parks Department successfully restocked the area along Carrizo Creek, which is in the Travessilla-Kim association.

The mourning dove population is good in those associations that support grain crops, but all soil associations have some potential for mourning doves.

Waterfowl hunting, especially goose hunting, is good in Baca County. Two Buttes Reservoir serves as a concentration and resting area from which waterfowl fly to the surrounding croplands to feed.

There are no natural fishing waters in Baca County, but Two Buttes Reservoir furnishes fishing, and fish ponds could be developed on several of the soil associations. Warm-water fish, such as bass, bluegill, and catfish, are generally recommended for stocking farm ponds. There is a high risk of ponds going dry because of erratic precipitation and recurring drought.

Some of the conservation practices that aid wildlife populations are stripcropping, proper range use, windbreaks, shelterbelts, farm ponds and other water impoundments, and the creation of wildlife areas to supply food and permanent nesting cover.

Technical advice on improvement of wildlife habitat can be obtained from the local representative of the Soil Conservation Service and from the wildlife conservation officer of the Colorado Game, Fish, and Parks Department.

Recreational Use of Soils [6]

Soil properties should be considered in determining the feasibility of various income-producing recreational enterprises. Not all soils are suited to growing desirable vegetation or to developing fish ponds, picnic areas, camp sites, and vacation cottages. Factors other than soil characteristics also should be considered, such as the distance from population centers, the type of scenery, and the prevailing climate. For example, shooting preserves more than 50 miles from large urban areas generally have little chance of success.

In table 5 are estimates of the recreational potential of the soil associations shown on the general soil map at the back of this survey. It should be noted that the ratings are generalized for all uses. Locations suited to a specific recreational use may occur within a soil association.

Improving the waterfowl habitat in areas under irrigation and then leasing the right for hunting ducks probably offers the best potential for the development of recreational facilities. Goose pits are already being leased or rented by landowners who are taking advantage of the large concentration of waterfowl that use Two Buttes Reservoir. Areas to be used for duck hunting must be diked and must have a gradient of no more than 1 percent. Water must be available for irrigating and flooding. Planting a crop, such as Japanese millet, in spring

[6] Prepared by ELDIE W. MUSTARD, state biologist, Soil Conservation Service.

TABLE 5.—*Suitability of soil associations for recreational uses*

Soil associations	Suitability for—							
	Vacation farms and dude ranches	Picnic and sports areas	Fishing	Campsites, scenic areas, and native areas	Hunting areas			Sites for rural cottages, camps, and homes
					Big game	Upland game	Waterfowl	
1. Richfield-Ulysses-Norka.	Poor	Poor	Not applicable.	Poor	Not applicable.	Good	Good	Poor.
2. Baca-Wiley	Poor	Poor	Not applicable.	Poor	Not applicable.	Good	Good	Poor.
3. Vona-Manter-Dalhart.	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor.
4. Travessilla-Kim	Poor	Fair	Fair	Fair	Fair	Fair	Not applicable.	Poor.
5. Wiley-Potter	Poor	Fair	Good	Fair	Poor	Poor	Not applicable.	Poor.
6. Minnequa-Manvel-Penrose.	Poor	Poor	Poor	Poor	Fair	Poor	Not applicable.	Poor.
7. Otero-Potter	Poor	Poor	Not applicable.	Poor	Poor	Good	Not applicable.	Poor.

and then flooding with 6 to 15 inches of water in fall provides excellent habitat for duck. The Richfield-Ulysses-Norka association, the Baca-Wiley association, and the Vona-Manter-Dalhart association are best suited for waterfowl hunting.

Pheasant hunting offers good income-producing recreational potential on the Richfield-Ulysses-Norka association, the Baca-Wiley association, and the Vona-Manter-Dalhart association. However, because of distance from urban centers, this activity could be relied upon to produce revenue only during opening weekend.

The Travessilla-Kim association is especially scenic in the area of Carrizo Creek, but high summer temperatures and too great a distance to main roads discourage many people from traveling in the area. The U.S. Forest Service is developing a camp and picnic area which will probably be adequate to take care of the demand, which is largely from local residents.

Engineering Uses of Soils [7]

The primary use of soil from an engineering standpoint is as a construction material. The engineer is therefore interested in the properties of the soil that determine the suitability of the soil as a building material and that impose limitations or special requirements for its use in construction.

The soil properties that are of special interest to the engineer are those that affect construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, irrigation and drainage, and sewage disposal systems. The soil properties most important to the engineer are permeability to water, shear strength, compaction characteristics, drainage, shrink-swell characteristics, dispersion, grain size, plasticity, depth of productive soil, and reaction. Depth to water table, depth to bedrock, available water capacity, and topography are also important.

The information in this section can be used by engineers to—

1. Make preliminary estimates of the engineering properties of soils in the planning of agricultural drainage systems, farm ponds, irrigation systems, and small erosion control structures.
2. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways, airports, pipelines, and cables, and in planning detailed investigations of the selected locations.
3. Locate probable sources of sand, gravel, or other construction materials.
4. Aid in selecting and developing industrial, business, residential, and recreational sites.
5. Correlate performance of engineering structures with soil mapping units to develop information that will be useful in designing and maintaining engineering structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps and reports and aerial photographs for the purpose of making maps and reports that can be used readily by engineers.

With use of the soil map for identification, the engineering interpretations in this section, and particularly in tables 6 and 7, can be useful for many purposes. It should be emphasized that these interpretations do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and excavations deeper than the depths of layers here reported. Even in these situations, the soil map is useful for planning more detailed field investigations and for suggesting the kinds of problems that may be expected.

Some of the terms used by the soil scientist may not be familiar to the engineer, and some words, for example, clay, silt, and sand, have different meanings in soil science. These terms and others are defined in the Glossary.

Engineering classification systems

The engineering systems now most widely used to classify soils are the Unified System (*11*) and the system developed by the American Association of State Highway Officials (AASHO) (*1*). Both systems differ from that used by the U.S. Department of Agriculture. In that system, the textural clasification is determined mainly by the percentage of soil material smaller than 2 millimeters.

In the Unified System soils are classified according to particle size distribution, plasticity, liquid limit, and organic-matter content. The symbols SW and SP are for clean sands; SM and SC are primarily for sands with nonplastic or plastic fines (G replaces S if the major coarse fraction is gravel); ML and CL are primarily for nonplastic or plastic, fine-grained materials of low liquid limit; and MH and CH are primarily for nonplastic or plastic, fine-grained materials of high liquid limit. Some soil materials have characteristics that are borderline between the major classes and are given a borderline classification, such as ML-CL.

The AASHO System is based on the bearing strength of soils. It groups soils of about the same general load-carrying capacity and serviceability. All materials are classified in seven basic groups. The groups range from A-1 (gravelly soils of high bearing capacity, the best soils for road subgrades) to A-7 (clayey soils having low strength when wet, the poorest soils for subgrades).

Engineering properties and interpretations

Table 6 provides estimated engineering properties of the soils in Baca County; and table 7, estimates of their suitability and limitations for common engineering purposes.

The estimated engineering properties of the soils in table 6 are for a typical profile that has been divided into its major horizons. Textural class and estimated Unified and AASHO classifications are given for each soil horizon. The columns under "Percentage passing sieve" show the percentage of soil material that passes through the openings in the screen specified.

Permeability is the ability of the soil to transmit water. As used in this soil survey, it is the permeability of the soil in place and is estimated from study of soil

[7] T. E. COLLARD and R. I. BLEWITT, engineers, Soil Conservation Service, assisted with this section.

TABLE 6.—*Estimated engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that

Soil series and map symbols	Depth from surface	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Coarse fragments greater than 3 inches
	Inches				*Percent*
Apache: Ap	0-15	Stony loam	ML	A-4	10-25
	15	Basalt.			
Baca: BaA, BaB, BaC	0-24	Clay loam	CL	A-6	
	24-60	Silt loam	ML or CL	A-4 or A-6	
Bankard: Bk	0-60	Sand	SP or SM	A-2	
Campo: Ca	0-40	Silty clay and silty loam	CH	A-7	
	40-60	Silty clay loam	ML or CL	A-4 or A-6	
Capulin: Cn	0-7	Loam	ML	A-4	
	7-60	Clay loam	CL	A-6	
Colby: CoA, CoB, CoD, CtA	0-60	Silt loam	ML or CL	A-4	
Dalhart:					
DaA, DaB	0-8	Loamy sand	SM	A-2	
	8-16	Sandy clay loam	SM	A-2	
	16-30	Sandy clay loam	SC or CL	A-6	
	30-38	Sandy loam	SM	A-2 or A-4	
	38-60	Loamy sand	SM	A-2	
DhA, DhB	0-10	Sandy loam	SM	A-4	
	10-36	Sandy clay loam	SC or CL	A-6	
	36-60	Sandy loam	SM	A-4	
Dune land: Du	0-60	Sand	SP	A-3	
Glenberg: Gb	0-60	Sandy loam	SM or SC	A-2	
Goshen: GoA, GoB	0-10	Loam	ML	A-4	
	10-60	Silty clay loam or clay loam	ML or CL	A-6	
Gravelly land: Gr	0-12	Gravelly loam	SM or SC	A-2 or A-4	0-5
	12-30	Gravelly loamy sand	SM	A-2	0-10
	30-60	Gravel	GW	A-2	0-10
Harbord: HaA, HaB, HaC	0-3	Loam	ML or CL	A-6	
	3-16	Silty clay loam	CL	A-6	
	16-60	Clay loam	CL	A-6	
Harvey: HrC	0-28	Loam and sandy clay loam	ML	A-4	
	28-60	Sandy loam	SM	A-4	
Kim: KmD	0-9	Loam	ML	A-4	
	9-17	Clay loam	CL	A-6	
	17-60	Clay loam	ML	A-4	
*Manter: MaA, MaB For Vona part, see Vona series.	0-60	Sandy loam	SM	A-2 or A-4	
Manvel	0-60	Silt loam	ML	A-4	
McCook: McA, McB	0-60	Loam	ML or CL	A-6	
*Minnequa: Mm For Manvel part, see Manvel series.	0-30	Loam	ML	A-4	
	30	Limestone.			
Norka	0-4	Silt loam	ML or CL	A-4	
	4-15	Silty clay loam	ML or CL	A-7	
	15-60	Silt loam	ML or CL	A-4	
Nunn: Nu	0-60	Clay loam	CL	A-6	

properties of the soils

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Percentage of less than 3 inches passing sieve				Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)				
				Inches per hour	*Inches per inch of soil*	*pH*	
80–90	75–85	65–75	50–60	0. 63–2. 0	0. 06–0. 09	7. 4–8. 4	Low.
100	100	90–100	90–100	0. 20–2. 0	0. 19–0. 21	7. 9–8. 3	Moderate.
100	100	90–100	85–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 3	Low.
60–85	50–70	30–40	5–10	6. 3–20. 0	0. 03–0. 07	7. 4–7. 8	Low.
100	100	90–100	90–95	0. 06–2. 0	0. 17–0. 19	7. 9–8. 4	Moderate to high.
100	100	90–100	90–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
95–100	95–100	85–95	75–90	0. 63–2. 0	0. 17–0. 19	7. 9–8. 4	Low.
95–100	95–100	85–95	75–90	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
95–100	95–100	90–100	90–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	95–100	50–70	15–20	2. 0–6. 3	0. 09–0. 11	7. 9–8. 4	Low.
100	95–100	60–80	25–35	2. 0–6. 3	0. 11–0. 13	7. 9–8. 4	Low.
100	95–100	80–90	40–80	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	Low.
100	95–100	60–80	30–40	0. 63–2. 0	0. 11–0. 13	7. 9–8. 4	Low.
100	95–100	50–75	15–20	2. 0–20. 0	0. 06–0. 09	7. 9–8. 4	Low.
100	95–100	60–80	35–45	0. 63–6. 3	0. 11–0. 13	7. 9–8. 4	Low.
100	100	80–90	45–55	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	Low.
100	100	60–80	35–45	0. 63–6. 3	0. 11–0. 13	7. 9–8. 4	Low.
100	100	50–70	0–5	6. 3–20. 0	0. 05–0. 07	7. 4–8. 4	Low.
90–100	80–100	60–80	15–40	6. 3–20. 0	0. 11–0. 13	7. 9–8. 4	Low.
100	100	85–95	60–75	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	90–100	85–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
70–85	60–75	50–60	35–40	0. 63–6. 3	0. 10–0. 16	7. 4–7. 8	Low.
75–85	30–40	25–30	20–25	6. 3–20. 0	0. 05–0. 10	7. 4–7. 8	Low.
30–40	15–30	10–20	5–10	6. 3–20. 0	0. 03–0. 09	7. 9–8. 4	Low.
100	100	85–95	70–85	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	90–100	85–95	0. 63–2. 0	0. 19–0. 21	7. 9–9. 0	Moderate.
100	100	90–100	70–85	0. 63–2. 0	0. 19–0. 21	8. 5–9. 0	Moderate.
95–100	90–95	75–85	60–80	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
85–95	80–95	60–80	35–45	0. 63–6. 3	0. 11–0. 13	7. 9–8. 4	Low.
95–100	95–100	90–95	60–80	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
95–100	95–100	90–100	85–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
90–100	90–100	90–95	60–80	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
90–100	90–100	55–70	25–40	6. 30–20. 0	0. 11–0. 13	7. 9–8. 4	Low.
95–100	90–100	90–95	50–75	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	Low.
95–100	95–100	85–95	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
95–100	90–100	85–95	50–75	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	Low.
100	100	95–100	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	90–100	80–95	0. 20–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
100	100	95–100	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	90–100	90–100	85–95	0. 06–0. 2	0. 19–0. 21	7. 9–8. 4	Moderate to high.

TABLE 6.—*Estimated engineering*

Soil series and map symbols	Depth from surface	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO	Coarse fragments greater than 3 inches
	Inches				*Percent*
*Otero: OeB, OeD, Op. For Potter part of Op, see Potter series.	0–60	Sandy loam	SM	A–2 or A–4	
Penrose: Pe	0–9	Channery loam	SM	A–2 or A–4	0–5
	9	Limestone.			
Potter: Po	0–8	Gravelly loam	SM	A–2 or A–4	0–5
	8	Caliche bedrock.			
Richfield: RcA	0–5	Silt loam	ML or CL	A–4	
	5–23	Silty clay loam	CL	A–6	
	23–60	Silt loam	ML or CL	A–4	
Rough stony land: Ro. Properties too variable to be estimated.					
Thedalund: Th	0–9	Silty clay loam	CL	A–6	
	9–30	Clay loam	CL or CH	A–6 or A–7	
	30	Gypsiferous shale and interbedded limestone.			
*Tivoli: Tn, To. For Dune land part of To, see Dune land.	0–60	Sand	SP or SM	A–3	
Travessilla: Tr	0–9	Stony sandy loam	SM	A–2	0–15
	9	Sandstone.			
*Ulysses: UnA, UnB. For Norka part, see Norka series.	0–7	Silt loam	ML or CL	A–4	
	7–12	Clay loam	CL	A–6	
	12–60	Loam	ML or CL	A–4	
Vona: VnB, VoC, Vr2	0–15	Sandy loam or loamy sand	SC or SM	A–4 or A–2	
	15–48	Sandy loam	SC or SM	A–2	
	48–60	Sand	SM	A–2	
Wages: Wa	0–4	Loam	ML	A–4	
	4–60	Clay loam	CL	A–6	
Wiley: WlA, WlB, WlC, WlD, Ws2	0–5	Loam	ML or CL	A–4	
	5–10	Silty clay loam	CL	A–6	
	10–60	Silt loam	ML or CL	A–4	

properties of the soils—Continued

Percentage of less than 3 inches passing sieve: No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.4 mm)	No. 200 (0.074 mm)	Permeability	Available water capacity	Reaction	Shrink-swell potential
				Inches per hour	*Inches per inch of soil*	*pH*	
90–100	85–95	60–80	25–40	6. 30–20. 0	0. 11–0. 13	7. 9–8. 4	Low.
60–85	55–80	40–55	30–40	0. 63–6. 3	0. 07–0. 11	7. 9–8. 4	Low.
60–70	55–65	30–50	25–40	0. 63–6. 3	0. 08–0. 12	7. 9–8. 4	Low.
100	100	95–100	80–95	0. 63–2. 0	0. 19–0. 21	7. 4–7. 8	Low.
100	100	95–100	85–100	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
100	100	95–100	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	90–100	70–90	0. 20–2. 0	0. 17–0. 19	7. 9–8. 4	Moderate.
95–100	95–100	90–100	70–90	0. 20–0. 63	0. 17–0. 19	7. 9–8. 4	Moderate.
100	100	50–70	0–12	6. 3–20. 0	0. 05–0. 09	7. 4–8. 4	Low.
60–80	55–75	25–35	15–25	0. 63–6. 3	0. 07–0. 09	7. 4–8. 4	Low.
100	100	95–100	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	95–100	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
100	100	85–95	80–95	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	50–80	15–40	6. 30–20. 0	0. 09–0. 16	7. 9–8. 4	Low.
100	100	60–80	25–40	6. 30–20. 0	0. 13–0. 15	7. 9–8. 4	Low.
100	95–100	50–75	15–25	6. 3–20. 0	0. 09–0. 11	7. 9–8. 4	Low.
100	100	90–100	70–85	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	90–100	75–90	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
100	100	90–100	90–100	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.
100	100	95–100	90–100	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Moderate.
100	100	95–100	90–100	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	Low.

TABLE 7.—*Engineering interpretations*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils tions for referring to other series that

Soil series and map symbol	Suitability of soil as a source of— Topsoil	Sand	Gravel	Road fill	Limitations for sewage disposal filter field
Apache: Ap	Poor: stony	Unsuitable	Unsuitable	Poor: shallow to basalt.	Severe: shallow soil.
Baca: BaA, BaB, BaC	Good	Unsuitable	Unsuitable	Fair: A-4 and A-6.	Moderate: moderately slow permeability.
Bankard: Bk	Poor to sandy	Good	Poor: less than 50 percent gravel.	Good with binder	Severe: subject to flooding.
Campo: Ca	Fair: clayey	Unsuitable	Unsuitable	Poor to fair: A-6 and A-7.	Severe: slow permeability.
Capulin: Cn	Good	Unsuitable	Unsuitable	Fair: A-4 and A-6.	Slight.
Colby: CoA, CoB, CoD, CtA	Good	Unsuitable	Unsuitable	Fair: A-4	Slight
Dalhart: DaA, DaB, DhA, DhB	Fair: sandy	Unsuitable	Unsuitable	Fair: A-4	Slight
Dune land: Du	Poor: sand	Good by screening.	Unsuitable	Good with binder	Severe: shifting sands.
Glenberg: Gb	Fair: sandy	Poor: availability unpredictable.	Poor: availability unpredictable.	Good	Slight
Goshen: GoA, GoB	Good	Unsuitable	Unsuitable	Fair: A-4 and A-6.	Slight; severe where subject to flooding.
Gravelly land: Gr	Poor: gravelly	Fair: 25 to 60 percent fines.	Fair: 25 to 60 percent fines.	Good	Slight to severe: variable slopes.
Harbord: HaA, HaB, HaC	Good	Unsuitable	Unsuitable	Fair: A-4 and A-6.	Slight
Harvey: HrC	Good	Unsuitable	Unsuitable	Fair: A-4	Slight
Kim: KmD	Good	Unsuitable	Unsuitable	Fair: A-4 and A-6.	Slight
*Manter: MaA, MaB For Vona part, see Vona series.	Fair: sandy	Unsuitable	Unsuitable	Good	Slight
Manvel	Fair: erodible	Unsuitable	Unsuitable	Fair: A-4	Slight
McCook: McA, McB	Good	Unsuitable	Unsuitable	Fair: A-4 and A-6.	Moderate: moderately slow permeability.
*Minnequa: Mm For Manvel part, see Manvel series.	Fair: erodible	Unsuitable	Unsuitable	Fair: A-4	Severe: bedrock at depth of 20 to 36 inches.
Norka	Good	Unsuitable	Unsuitable	Fair: A-4	Slight

See footnote at end of table.

of soil properties

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instruc-
appear in the first column of this table]

Soil features affecting—				
Highway location	Dikes and diversions	Farm ponds		Irrigation
		Reservoir area	Embankment	
Shallow to bedrock	Rough, broken topography.	Too shallow	Erodible slopes	Rough, broken topography.
(1)	Erodible slopes	(1)	Erodible slopes	Some slopes of 1 to 5 percent.
Subject to flooding	Rapid permeability erodible slopes.	Rapid permeability	Rapid permeability; erodible slopes.	Very low available water capacity; subject to flooding.
Susceptible to ponding; highly plastic when wet.	Cracks when dry	(1)	Cracks when dry	Concave topography; slow permeability.
(1)	(1)	(1)	(1)	(1).
(1)	Erodible slopes	Moderate permeability.	Erodible slopes	Some slopes of 1 to 9 percent.
(1)	Erodible slopes	Moderate permeability.	Erodible slopes	Moderate available water capacity; erodible surface soil.
Shifting sands	Shifting sands	Rapid permeability	Shifting sands	Very low available water capacity; dune topography.
May be subject to flooding.	Moderate permeability when compacted.	Rapid permeability	Moderate permeability when compacted.	Low available water capacity; rapid permeability.
May be subject to flooding.	(1)	(1)	(1)	May be subject to flooding.
(1)	Rapid permeability	Rapid permeability	Rapid permeability	Very low available water capacity.
(1)	(1)	(1)	(1)	Some slopes of 1 to 5 percent.
(1)	(1)	Moderate permeability.	(1)	Slopes of 1 to 5 percent.
Unstable slopes	Erodible slopes	Low seepage	Erodible slopes	Slopes of 1 to 9 percent.
(1)	(1)	High seepage	Moderate permeability when compacted.	Moderate available water capacity; erodible surface soil.
(1)	Erodible slopes	Moderate seepage	Erodible slopes	Slopes of 1 to 9 percent.
(1)	(1)	Moderate seepage	(1)	Slopes of 1 to 3 percent.
Bedrock at depth of 20 to 36 inches.	Erodible slopes	Moderate seepage	Erodible slopes	Slopes of 1 to 9 percent; limestone at depth of 20 to 36 inches.
(1)	Erodible slopes	Moderate seepage	Erodible slopes	Slopes of 1 to 3 percent.

TABLE 7.—*Engineering interpretations*

Soil series and map symbol	Suitability of soil as a source of—				Limitations for sewage disposal filter field
	Topsoil	Sand	Gravel	Road fill	
Nunn: Nu	Good	Unsuitable	Unsuitable	Poor to fair: A–6 and A–7.	Severe: slow permeability.
*Otero: OeB, OeD, Op. For Potter part of Op, see Potter series.	Fair: sandy	Unsuitable	Unsuitable	Good	Slight
Penrose: Pe	Poor: shallow	Unsuitable	Unsuitable	Poor: shallow to limestone.	Severe: shallow to limestone.
Potter: Po	Poor: shallow	Unsuitable	Unsuitable	Good	Severe: shallow to caliche.
Richfield: RcA	Good	Unsuitable	Unsuitable	Fair: A–4 and A–6.	Slight
Rough stony land: Ro	Poor: stony	Poor: availability unpredictable.	Poor: availability unpredictable.	Poor: steep and variable.	Severe: too steep
Thedalund: Th	Poor: clayey	Unsuitable	Unsuitable	Poor to fair: A–7 and A–6.	Severe: moderately slow permeability; shale at a depth of 20 to 30 inches.
*Tivoli: Tn, To. For Dune land part of To, see Dune land.	Poor: sandy	Fair for fine sand.	Unsuitable	Good with binder	Slight
Travessilla: Tr	Poor: shallow	Unsuitable	Unsuitable	Poor: shallow to bedrock.	Severe: shallow to sandstone.
*Ulysses: UnA, UnB. For Norka part, see Norka series.	Good	Unsuitable	Unsuitable	Fair: A–4 and A–6.	Slight
Vona: VnB, VoC, Vr2	Fair: sandy	Unsuitable	Unsuitable	Good	Slight
Wages: Wa	Good	Unsuitable	Unsuitable	Fair: A–4 and A–6.	Slight
Wiley: WlA, WlB, WlC, WlD, Ws2.	Good	Unsuitable	Unsuitable	Fair: A–4 and A–6.	Slight

[1] No significant adverse features.

of soil properties—Continued

Soil features affecting—				
Highway location	Dikes and diversions	Farm ponds: Reservoir area	Farm ponds: Embankment	Irrigation
(1)	(1)	(1)	(1)	Slow permeability.
(1)	Erodible slopes	Rapid permeability	(1)	Low to medium available water capacity; slopes of 1 to 9 percent.
Shallow to limestone	Shallow to limestone	Shallow to limestone	Shallow to limestone	Shallow to limestone.
Shallow to caliche	Shallow to caliche	Shallow to caliche	Shallow to caliche	Very low available water capacity.
(1)	(1)	(1)	(1)	(1).
Steep	Steep	Steep	Steep	Steep.
Shale at depth of 20 to 30 inches; erodible slopes.	Erodible slopes	Moderate seepage; subject to piping.	Erodible slopes	Shale at depth of 20 to 30 inches; slopes of 1 to 6 percent.
Erodible slopes	Erodible slopes	Rapid permeability	Erodible slopes	Very low available water capacity; highly erodible.
Shallow to bedrock	Shallow to bedrock	Shallow to bedrock; slopes of 1 to 25 percent.	Shallow to bedrock	Shallow to bedrock; stony; slopes of 1 to 25 percent.
(1)	(1)	Moderate seepage	(1)	(1).
Erodible slopes	Erodible slopes	Rapid permeability	Erodible slopes	Moderate available water capacity; erodible surface.
(1)	(1)	(1)	(1)	Slopes of 1 to 3 percent.
(1)	(1)	Slopes of 1 to 9 percent.	(1)	Slopes of 1 to 9 percent.

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structure and porosity and by comparison with permeability tests on cores of similar undisturbed soil material.

Available water capacity is the approximate amount of water held in the soil in a form plants can readily use. When the soil is at the wilting point of common crops, this amount of water will wet the soil material described to a depth of one inch without further percolation.

Reaction refers to the degree of acidity or alkalinity of a soil and is expressed in pH values. The soil pH indicates the corrosiveness of the soil solution and the protection needed for pipelines or similar structures that are placed in the soil.

Shrink-swell potential is an indication of the volume change to be expected of the soil materials with changes in moisture content. In general, soils classed as CH and A-7 have high shrink-swell potential, and clean, structureless sands and other nonplastic soil materials have low shrink-swell potential.

Dispersion is not a significant problem in the use of soils in Baca County for engineering construction. There are no highly dispersed clays in the county. Those having more than low dispersion in some layer are the Harvey (moderate at a depth of 0 to 28 inches); Kim (moderate to low at a depth of 9 to 17 inches); Manter (moderate at a depth of 0 to 60 inches); Minnequa (moderate at a depth of 0 to 30 inches); Thedalund (moderate at a depth of 9 to 30 inches); and Wiley (moderate to low at a depth of 5 to 10 inches).

The dryland soils and irrigated soils generally have sufficient permeability so that agricultural drainage is not a problem.

Table 7 rates the soils according to their suitability as a source of construction material and topsoil, shows limitations of the soils as sites for sewage disposal fields, and mentions those features of the soils having most effect on their suitability as locations for highways and farm structures that store or control movement of water.

Formation and Classification of Soils

This section first describes the factors of soil formation and their effect on the formation of soils in Baca County. The second part shows how the soils of this county have been classified according to the two systems of classification used in the United States.

Factors of Soil Formation

Soil is produced by the action of soil-forming processes (*6*) on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the soil material.

Climate and vegetation are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and vegetation are conditioned by relief. Parent material also affects the kind of profile that can be formed, and in extreme cases, determines it almost entirely. Finally, time is needed for the changing of the parent material into a soil profile. Usually a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil formation are unknown.

Parent material

Parent material determines to a large extent the structure, texture, consistence, color, arrangement of horizons, and to some degree the fertility and erodibility of the soil. The soils in Baca County formed in seven basic parent materials: (1) loess, (2) eolian sands, (3) alluvium, (4) tertiary outwash, (5) sandstone, (6) limestone and shale, and (7) basalt.

Soils developed from loess occupy the largest acreage in the county. Loess is calcareous and has a high percentage of silt and a very low percentage of coarse material. Even though all of th loess was probably deposited late in the Pleistocene age and early in the Recent age, the soils developed in it are not all the same (*2, 7*). Some of the differences in soils that developed in this kind of parent material may be the result of different degrees of erosion in prehistoric times. Other differences may have been caused by differences in the climate or in relief. Richfield, Ulysses, Campo, Baca, Wiley, and Colby soils developed from loess.

Soils developed from eolian sand deposits occupy large areas in the southern and western parts of the county. These deposits are calcareous medium and fine sand. The sand was deposited after the loess and was probably blown out of stream beds. The soils that developed from this sandy material were affected as much by the composition of the parent material as by other soil-forming factors. Tivoli, Vona, Dalhart, and Manter soils developed from eolian sand.

Soils developed from tertiary outwash of the Ogallala terraces and in upland swales or along streams and on low terraces. The alluvium on high terraces and in upland swales is of the Pleistocene age. The alluvium along streams and on low terraces was deposited recently. Areas of this alluvium are susceptible to flooding, and the soils are young and poorly developed. Wages, McCook, Glenberg, and Bankard soils developed in alluvium.

Soils developed from tertiary outwash of the Ogallala Formation occupy relatively small areas scattered over the county. Tertiary outwash is of the Pliocene age. In most areas, it has a thin loess mantle and in many places is cemented with lime. The differences between the soils that formed in this material are primarily due to the differences in the composition of the parent material, in relief, and in the time soil-forming factors have acted. Harvey and Potter soils developed in tertiary outwash.

Soils developed from sandstone crop out along major drainageways throughout Baca County and occupy large areas in the western and southwestern parts of the county. The sandstone is mostly of the Dakota Formation of the Lower Cretaceous age. It contains shale that causes some

differences between soils. Soils that formed in sandstone generally are young because the sand is very resistant to weathering. Travessilla soils developed in sandstone.

Soils developed from limestone and limy shale of the Neobrara Formation occur in the northwestern part of the county and are not widely distributed. These soils are very calcareous and contain large amounts of gypsum. They are young because the soil material erodes as fast as it is formed through weathering. Penrose, Minnequa, and Manvel soils developed from limestone and limy shale.

Soils developed from basalt occur in the southwestern part of the county and are not extensive. Basalt rock caps many of the mesas in this area and is very resistant to weathering. Soils developed from this parent material are young because the soil material erodes as fast as it is formed through weathering. Apache and Capulin soils developed from basalt.

Climate

Climate affects the physical and chemical weathering of the parent material. Moisture and temperature work together to affect the soil-forming processes. Moisture in the soil dissolves minerals and carries them out of the soil, while the temperature affects the growth of organisms.

Because of the dry climate, soils in Baca County show little weathering. Calcium carbonate, which is water soluble, is present in nearly all the soils, and in most of these, it is not leached below a depth of 12 inches. A few soils on the eastern boundary of the county have been leached to a greater depth.

Relief

Relief, or topography, influences soil formation by modifying the effects of climate, erosion, and vegetation. Steep soils absorb less moisture, have less vegetation and a less well-developed profile, and erode more easily than less sloping soils. Because soils on flats and in depressions receive additional moisture, they are generally well developed and have more vegetation.

Plant and animal life

Plants and animals are extremely important in the development of soils. Micro-organisms, bacteria, small burrowing animals, worms, insects, and fungi help to weather rock and decompose organic matter. Plants add organic matter, which in turn is acted upon by micro-organisms. This action influences the structure and physical condition of the soil.

The type and amount of vegetation are important and are determined by the climate and soil material. Most of the soils in Baca County have developed under grass. As a result, the upper horizon generally is dark colored and moderately high in content of organic matter. In many soils a finer textured and lighter colored horizon has developed below the upper horizon.

Time

Generally, a long time is necessary for the formation of soils that have distinct horizons. The age of a soil cannot be measured in years. Time is relative and depends on the other soil-forming processes. Soils that developed from similar parent materials of the same age may differ because of differences in erosion, topography, and effective moisture. The age of soil is indicated by the depth to lime, the structure, and profile development. An alluvial soil that has very little profile development, such as Bankard sand, is considered young. Leached soils that have strong structure, such as Richfield soils, are considered more mature.

Classification of Soils

Soils are classified so that we may more easily remember their significant characteristics, assemble knowledge about them, see their relationships to one another and to the whole environment, and develop principles that help us understand their behavior and response to management. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 and revised later. The system currently used by the National Cooperative Soil Survey was adopted in 1965 (*8*, *9*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. This classification is designed to accommodate all soils. It employs a nomenclature that is connotative and distinctive. The criteria for soil classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. Genesis, or mode of soil origin, does not appear in the definition of the classes; it lies behind the classes.

Table 8 shows the classification of the soil series of Baca County according to some of the classes in the current system. It also shows one category, the great soil group, of the 1938 system. Following are brief descriptions of each of the six categories in the current system.

Order.—Ten soil orders are recognized in the classification system, and four of these orders are represented in Baca County—Entisols, Mollisols, Alfisols, and Aridisols. The orders are primarily broad climatic groupings. Entisols are an exception in that they occur in many different climates. Each order is named with a three or four syllable word ending in sol (Arid-i-sol).

Entisols are young soils which are just beginning to develop. This order includes soils formerly classified as Chestnut soils. Alluvial soils, or Lithosols.

Mollisols have a thick, dark-colored surface horizon. This order includes some of the soils that were formerly classified as Chestnut soils. Alluvial soils, or Lithosols.

Alfisols are mineral soils that lack an oxic horizon and do not have a mollic epipedon. They include soils that were formerly classified as Brown soils or Chestnut soils.

Aridisols have a B horizon and a light-colored surface layer. This order includes some of the soils formerly classed as Brown soils, Calcisols, and Lithosols.

Suborder.—Each order is divided into suborders, primarily on the basis of soil characteristics that seem to produce classes with the greatest genetic similarity. The

TABLE 8.—*Soil series in Baca County classified into higher categories*

Series	Current classification system			1938 classification
	Family	Subgroup	Order	Great soil group
Apache	Loamy, mixed, mesic	Aridic Lithic Haplustolls	Mollisols	Lithosols.
Baca	Fine, montmorillonitic, mesic	Ustollic Haplargids	Aridisols	Brown soils.
Bankard	Sandy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols	Alluvial soils.
Campo	Fine, montmorillonitic, mesic	Ustollic Paleargids	Aridisols	Brown soils.
Capulin	Fine-loamy, mixed, mesic	Aridic Argiustolls	Alfisols	Chestnut soils.
Colby	Fine-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols	Regosols.
Dalhart [1]	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols	Chestnut soils.
Glenberg	Coarse-loamy, mixed (calcareous), mesic	Ustic Torrifluvents	Entisols	Alluvial soils.
Goshen	Fine-silty, mixed, mesic	Pachic Argiustolls	Mollisols	Chestnut soils.
Harbord	Fine-loamy, mixed, mesic	Ustollic Haplargids	Aridisols	Brown soils.
Harvey	Fine-loamy, mixed, mesic	Ustollic Calciorthids	Aridisols	Calcisols.
Kim	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols	Regosols.
Manter	Coarse-loamy, mixed, mesic	Aridic Argiustolls	Mollisols	Chestnut soils.
Manvel	Fine-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols	Regosols.
McCook	Fine-loamy, mixed, mesic	Fluventic Haplustolls	Mollisols	Chestnut soils.
Minnequa	Fine-silty, mixed (calcareous), mesic	Ustic Torriorthents	Entisols	Regosols.
Norka	Fine-silty, mixed, mesic	Aridic Argiustolls	Mollisols	Chestnut soils.
Nunn	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols	Chestnut soils.
Otero	Coarse-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols	Regosols.
Penrose	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols	Lithosols.
Potter [2]	Fine-carbonatic, mesic, shallow	Ustollic Calciorthids	Aridisols	Lithosols.
Richfield	Fine, montmorillonitic, mesic	Aridic Argiustolls	Mollisols	Chestnut soils.
Thedalund	Fine-loamy, mixed (calcareous), mesic	Ustic Torriorthents	Entisols	Regosols.
Tivoli [3]	Mixed, thermic	Typic Ustipsamments	Entisols	Regosols.
Travessilla	Loamy, mixed (calcareous), mesic	Lithic Ustic Torriorthents	Entisols	Lithosols.
Ulysses	Fine-silty, mixed, mesic	Aridic Haplustolls	Mollisols	Chestnut soils.
Vona	Coarse-loamy, mixed, mesic	Ustollic Haplargids	Aridisols	Brown soils.
Wages	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols	Chestnut soils.
Wiley	Fine-silty, mixed, mesic	Ustollic Haplargids	Aridisols	Brown soils.

[1] Latest revision of the classification system would place the Dalhart soils in Baca County in the Ascalon series.
[2] The Potter soils in Baca County are mesic taxadjuncts of the Potter series.
[3] Latest revision of the classification system would place the Tivoli soils in Baca County in the Valent series.

suborder has a narrower climatic range than the order. Soil properties used to separate suborders are mainly those that reflect differences resulting from parent material, climate, vegetation, and in some situations, the presence or absence of water-logging. The names of the suborders have two syllables, the last syllable of which indicates the order. An example is Argids (Arg, meaning a horizon with alluvial clay, and id meaning Aridisol).

GREAT GROUP.—Soil suborders are divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. The features used are soil temperature, major differences in chemical composition (mainly calcium, sodium, mag- of any other great group, suborder, or order. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplargid (Hapl, meaning simple; arg, meaning having a horizon of alluvial clay; and id, meaning Aridisol).

SUBGROUP.—Great groups are divided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, representing the soils that have properties of one great soil group, but also one or more properties of the soils of another great group, suborder, or order. Subgroups may also be made in those cases where soil properties intergrade outside of the range of any great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Ustollic Haplargid (a dark-colored Haplargid).

FAMILIES.—Families are established within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentia. An example is the fine, montmorillonitic, mesic family of Ustollic Haplargids.

All of the soils in Baca County are mesic. These terms refer to soil temperature classes. Mesic soils are those soils with 9° F. or more difference (at a depth of 20 inches) between mean summer temperature (June, July, and August) and mean winter temperature (December, January, and February), and with a mean annual temperature (at a depth of 26 inches) between 47° F. and 59° F. Frigid soils have lower mean annual temperatures, and tepid soils have warmer mean annual temperatures than mesic soils. Over a large part of the United States, the mean annual soil temperature at a depth of 20 inches is about 2 degrees warmer than the mean annual temperature. Thus, the mean annual soil temperature in Baca County is about 54° F.

SERIES.—The series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. They are given the name of a geographic location near the place where that series was first observed and mapped. An example is Baca soil.

General Nature of the County

Baca County was organized in 1889, with Springfield as the county seat. Springfield and Walsh are the largest towns in the county, and both are dependent on agriculture as their main source of income. Two major highways and a railroad make it possible to market livestock in Denver or Kansas City.

Nonirrigated farming is the most important enterprise in the county. Wheat and sorghum are common crops on the loamy soils, and sorghums and broomcorn are common crops on the sandy soils. About 30,000 acres is irrigated with water pumped from wells. At present, wheat, sorghum, and beets are the common irrigated crops, but broomcorn and potatoes are grown by a few farmers, and the acreage used for these crops will probably increase as more areas are irrigated.

Physiography, Relief, and Drainage

Baca County is located within the physiographic province of the Great Plains (*7*). The elevation ranges from 5,000 feet on the western boundary to about 3,500 feet in the southwestern corner of the county. Physiography, relief, and drainage vary widely, but the major part of the county consists of nearly level plains crossed by small intermittent streams that have steep slopes and narrow terraces. The major drainageways are Bear Creek, Sand Arroyo, Horse Creek, and Two Buttes Creek. These streams drain northeast and east across the county into Kansas. Two Buttes Creek drains north of the town of Two Buttes and enters the Arkansas River at Holly.

The southwestern and northwestern parts of the county are steep. Nearly vertical sandstone cliffs and escarpments dominate the landscape and form narrow valleys that have small terraces. Near the southwestern boundary of the county, relief slopes southward, and Carrizo Creek and its tributaries are the most important drainages.

The northwestern corner of the county is steep and rocky, and characterized by sandstone and limestone ledges. The relief slopes mainly north and northwest. Two Buttes Creek and Hackberry Creek drain this area and flow into the Arkansas River.

Except for the southwestern corner of the county, the southern part drains to the south. The slopes are nearly level. Intermittent streams and waterways drain into the Cimarron River. Along the Cimarron River are low-lying sandhills that have steep slopes in places.

Climate [8]

Baca County has a warm, semiarid continental climate with long, hot summer days and relatively cool nights. Winters are short, with extremely variable temperatures. The average annual temperature at Springfield, which is at 4,405 feet elevation, is about 54° F. The warmest recorded temperature is 113° F., and the coldest is −25° F. July is the warmest month with a mean temperature of 77.5° F., and January is the coldest month, with a mean temperature of 32.2° F. Tables 9 and 10 show the temperature and precipitation data for Springfield and Two Buttes.

About 75 percent of the precipitation falls between March and September in the form of rain. Because rainfall is unreliable, nonirrigated farming is hazardous. One year in 44 years has a probability of having 7.00 to 7.99 inches of precipitation, and 1 year in 44 years has a probability of 26.00 to 26.99 inches of precipitation. Five years out of 44 years have a probability of 16.00 to 16.99 inches of precipitation. The average date of the last freeze in spring is April 30, and the average date of the first freeze in fall is October 11. In Springfield there is an average of 164 frost-free days, and in Two Buttes there is an average of 169 frost-free days.

Some snow falls every winter. If it is not blown by wind, the snow covers the soils and, as it melts, provides valuable moisture. If blown by wind, as during a blizzard, the snow may collect in fence rows, block highways, and strand livestock.

Wind is most common in the spring and summer. It causes duststorms that block highways, kill livestock, and ruin crops. The static electricity generated during these storms causes fires in crops and stalls automobiles. Nearly all the conservation practices in Baca County are aimed at preventing these duststorms.

Sudden hailstorms are common in summer. Usually they affect only small areas, but they severely damage crops and buildings.

[8] Prepared by J. W. BERRY, climatologist for Colorado, National Weather Service, U.S. Department of Commerce.

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TABLE 9.—*Temperature and precipitation data*

[Data for temperature and snow cover from Springfield, elevation 4,405 feet. Period of record 1948–62]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Days with snow cover	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	°F.	°F.	°F.	°F.	In.	In.	In.		In.
January	48	16	68	−1	0.47	0.1	1.0	4	3
February	51	20	69	4	.46	.1	.7	4	3
March	56	24	76	7	1.05	.3	1.6	3	6
April	68	35	83	24	1.31	.4	2.2	(1)	1
May	76	45	93	33	2.58	1.0	3.9	----------	----------
June	88	56	100	45	2.01	.7	3.2	----------	----------
July	91	60	99	54	2.07	.7	3.4	----------	----------
August	90	59	98	49	1.79	.8	3.2	----------	----------
September	85	50	95	39	1.16	.2	1.8	----------	----------
October	73	38	87	26	.85	.2	1.4	----------	----------
November	57	24	75	8	.55	.1	.8	4	4
December	52	18	69	5	.43	.1	.8	2	2
Year	70	37	[2] 102	[3] −11	14.73	10.5	17.8	17	3

[1] Less than one-half day.
[2] Average annual highest maximum.
[3] Average annual lowest minimum.

TABLE 10.—*Average mean maximal and mean minimal temperature*

[Data for temperature from Two Buttes, elevation 4,075 feet, period of record 1902–52. Data for precipitation based on records for the period 1887 to 1957]

Month	Temperature					Precipitation				
	Average	Highest	Average maximum	Lowest	Average minimum	Average	Highest	Driest year	Wettest year	Average snow
	°F.	°F.	°F.	°F.	°F.	In.	In.	In.	In.	In.
December	32.7	83	47.7	−23	17.9	0.54	2.31	0.38	0.75	2.8
January	31.4	80	46.8	−25	16.0	.34	1.56	(1)	1.08	2.9
February	33.9	80	49.1	−26	18.5	.55	2.21	.01	.62	4.8
March	42.3	94	58.6	−16	26.0	.80	4.08	.75	1.56	3.5
April	52.0	92	68.0	4	36.0	1.69	7.70	.55	2.02	2.0
May	61.2	100	76.7	14	45.7	2.18	8.18	1.45	4.50	.2
June	71.4	110	86.7	31	56.2	2.19	8.05	.72	3.91	.0
July	77.0	111	92.3	40	61.7	2.34	8.56	1.96	3.59	.0
August	75.4	111	91.3	39	59.5	1.84	6.63	1.00	4.18	.0
September	67.4	105	83.6	27	51.1	1.35	5.42	.00	5.42	.3
October	55.3	94	72.2	−2	38.4	.85	4.55	.34	3.43	.3
November	42.3	89	58.9	−8	25.6	.45	1.97	.83	.40	2.0
Year	53.5	111	69.3	−26	37.7	15.12	31.46	7.99	31.46	18.8

[1] Amount of precipitation is too small to measure.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available moisture (or water) capacity. The capacity of a soil to hold water in a form available to plants. Amount of moisture held in soil between field capacity, or about one-third atmosphere of tension, and the wilting coefficient, or about 15 atmospheres of tension.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Chiseling. Tillage with a machine that has one or more soil-penetrating points that can be drawn through the soil to loosen the subsoil, generally to a depth of 12 to 18 inches. This machine is used for emergency tillage; the clods it brings to the soil surface deflect erosive wind.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Contour farming. Plowing, cultivating, planting, and harvesting in rows that are either at right angles to the natural direction of the slope or parallel to the terrace grade.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic matter and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil, from the unconsolidated parent material, as conditioned by relief and age of landform.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substances.

Horizon, soil. A layer of soil approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an *O horizon.* This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loess. A fine-grained eolian deposit consisting dominantly of silt-sized particles.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Natural soil drainage. Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and C horizons.

Somewhat poorly drained soils are wet for significant periods, but not all the time, and some soils commonly have mottlings below 6 to 16 inches, in the lower A horizon and in the B and C horizons.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rotation grazing. Grazing two or more pastures, or parts of a range, in regular order, with definite recovery periods between grazing periods. Contrasts with continuous grazing.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces in-

tended mainly for drainage have a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. Dashed lines indicate the soil was not placed in that particular grouping. Information is given in tables as follows:

Acreage and extent, table 1, page 5.
Predicted yields of nonirrigated crops, table 2, page 31.
Predicted yields of irrigated crops, table 3, page 32.
Suitability of soil associations for wildlife habitat, table 4, page 37.
Suitability of soil associations for recreational uses, table 5, page 38.
Engineering uses of soils, tables 6 and 7, pages 40 through 47.

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site: Name	Range site: Page	Windbreak group: Name
Ap	Apache stony loam	6	------	--	VIIs-1	30	Basalt Breaks	35	---------
BaA	Baca clay loam, 0 to 1 percent slopes	7	I-1	27	IVe-1	29	Loamy Plains	33	Loamy
BaB	Baca clay loam, 1 to 3 percent slopes	7	IIe-1	27	IVe-1	29	Loamy Plains	33	Loamy
BaC	Baca clay loam, 3 to 5 percent slopes	7	IIIe-2	28	IVe-2	29	Loamy Plains	33	Loamy
Bk	Bankard sand	7	------	--	VIIw-1	30	----------------	--	---------
Ca	Campo clay loam	8	IIs-1	28	IVe-1	29	Loamy Plains	33	Loamy
Cn	Capulin loam	8	------	--	IIIc-1	28	Basalt Loam	34	Loamy
CoA	Colby silt loam, 0 to 1 percent slopes	9	I-1	27	IVe-1	29	Loamy Plains	33	Loamy
CoB	Colby silt loam, 1 to 3 percent slopes	9	IIe-1	27	IVe-1	29	Loamy Plains	33	Loamy
CoD	Colby silt loam, 3 to 9 percent slopes	9	------	--	VIe-1	29	Loamy Plains	33	Loamy
CtA	Colby silt loam, terrace, 0 to 2 percent slopes	9	I-1	27	IVe-1	29	Loamy Plains	33	Loamy
DaA	Dalhart loamy sand, 0 to 1 percent slopes	10	IIIe-3	28	IVe-4	29	Sandy Plains	34	Sandy
DaB	Dalhart loamy sand, 1 to 3 percent slopes	10	IIIe-3	28	IVe-4	29	Sandy Plains	34	Sandy
DhA	Dalhart sandy loam, 0 to 1 percent slopes	11	I-2	27	IIIe-4	28	Sandy Plains	34	Sandy
DhB	Dalhart sandy loam, 1 to 3 percent slopes	11	IIe-2	28	IIIe-4	28	Sandy Plains	34	Sandy
Du	Dune land	11	------	--	VIIIe-1	30	----------------	--	---------
Gb	Glenberg sandy loam	11	IIs-2	28	IVe-3	29	Sandy Bottomland	34	Sandy
GoA	Goshen loam, 0 to 1 percent slopes	12	I-1	27	IIIc-1	28	Loamy Plains	33	Loamy
GoB	Goshen loam, 1 to 3 percent slopes	13	IIe-1	27	IIIc-1	28	Loamy Plains	33	Loamy
Gr	Gravelly land	13	------	--	VIIs-2	30	Gravel Breaks	35	---------
HaA	Harbord loam, 0 to 1 percent slopes	13	I-1	27	IVe-1	29	Loamy Plains	33	Loamy
HaB	Harbord loam, 1 to 3 percent slopes	13	IIe-1	27	IVe-1	29	Loamy Plains	33	Loamy
HaC	Harbord loam, 3 to 5 percent slopes	13	IIIe-2	28	IVe-2	29	Loamy Plains	33	Loamy
HrC	Harvey loam, 1 to 5 percent slopes	14	------	--	VIe-1	29	Loamy Plains	33	Loamy
KmD	Kim loam, 0 to 9 percent slopes	14	------	--	VIe-1	29	Loamy Plains	33	Loamy
MaA	Manter and Vona sandy loams, 0 to 1 percent slopes	15	IIs-2	28	IVe-3	29	Sandy Plains	34	Sandy
MaB	Manter and Vona sandy loams, 1 to 3 percent slopes	15	IIIe-1	28	IVe-3	29	Sandy Plains	34	Sandy
McA	McCook loam, 0 to 1 percent slopes	16	I-1	27	IIIc-1	28	Loamy Plains	33	Loamy
McB	McCook loam, 1 to 3 percent slopes	16	IIe-1	27	IIIc-1	28	Loamy Plains	33	Loamy
Mm	Minnequa-Manvel complex	17	------	--	VIe-1	29	Loamy Plains	33	---------
Nu	Nunn clay loam	18	IIs-1	28	IIIc-1	28	Loamy Plains	33	Loamy

Map symbol	Mapping unit	Described on page	Capability unit: Irrigated Symbol	Irrigated Page	Nonirrigated Symbol	Nonirrigated Page	Range site Name	Range site Page	Windbreak group Name
OeB	Otero sandy loam, 0 to 3 percent slopes----------------------------	18	IIIe-1	28	IVe-3	29	Sandy Plains	34	Sandy
OeD	Otero sandy loam, 3 to 9 percent slopes----------------------------	18	------	--	VIe-3	30	Sandy Plains	34	Sandy
Op	Otero-Potter complex----------------	18	------	--	VIe-3	30	-----------------	--	--------
	Otero part----------------------	--	------	--	------	--	Sandy Plains	34	Sandy
	Potter part---------------------	--	------	--	------	--	Gravel Breaks	35	--------
Pe	Penrose channery loam---------------	19	------	--	VIIs-3	30	Limestone Breaks	35	--------
Po	Potter gravelly loam----------------	19	------	--	VIIs-2	30	Gravel Breaks	35	--------
RcA	Richfield silt loam, 0 to 1 percent slopes----------------------------	20	I-1	27	IIIc-1	28	Loamy Plains	33	Loamy
Ro	Rough stony land--------------------	20	------	---	VIIs-4	30	Sandstone Breaks	35	--------
Th	Thedalund silty clay loam-----------	20	------	--	VIe-2	29	Shaly Plains	34	--------
Tn	Tivoli sand-------------------------	21	------	--	VIe-4	30	Deep Sand	34	--------
To	Tivoli-Dune land complex------------	21	------	--	VIIe-1	30	Choppy Sand	34	--------
Tr	Travessilla stony sandy loam--------	21	------	--	VIIs-4	30	Sandstone Breaks	35	--------
UnA	Ulysses and Norka silt loams, 0 to 1 percent slopes------------------	22	I-1	27	IIIc-1	28	Loamy Plains	33	Loamy
UnB	Ulysses and Norka silt loams, 1 to 3 percent slopes------------------	22	IIe-1	27	IIIc-1	28	Loamy Plains	33	Loamy
VnB	Vona loamy sand, 0 to 3 percent slopes----------------------------	23	------	--	IVe-4	29	Sandy Plains	34	Sandy
VoC	Vona sandy loam, 3 to 5 percent slopes----------------------------	23	------	--	VIe-3	30	Sandy Plains	34	Sandy
Vr2	Vona soils, eroded------------------	23	------	--	VIe-3	30	Sandy Plains	34	Sandy
Wa	Wages loam--------------------------	24	IIe-1	27	IIIc-1	28	Loamy Plains	33	Loamy
W1A	Wiley loam, 0 to 1 percent slopes---	24	I-1	27	IVe-1	29	Loamy Plains	33	Loamy
W1B	Wiley loam, 1 to 3 percent slopes---	25	IIe-1	27	IVe-1	29	Loamy Plains	33	Loamy
W1C	Wiley loam, 3 to 5 percent slopes---	25	IIIe-2	28	IVe-2	29	Loamy Plains	33	Loamy
W1D	Wiley loam, 5 to 9 percent slopes---	25	------	--	VIe-1	29	Loamy Plains	33	Loamy
Ws2	Wiley soils, eroded-----------------	25	------	--	IVe-1	29	Loamy Plains	33	Loamy

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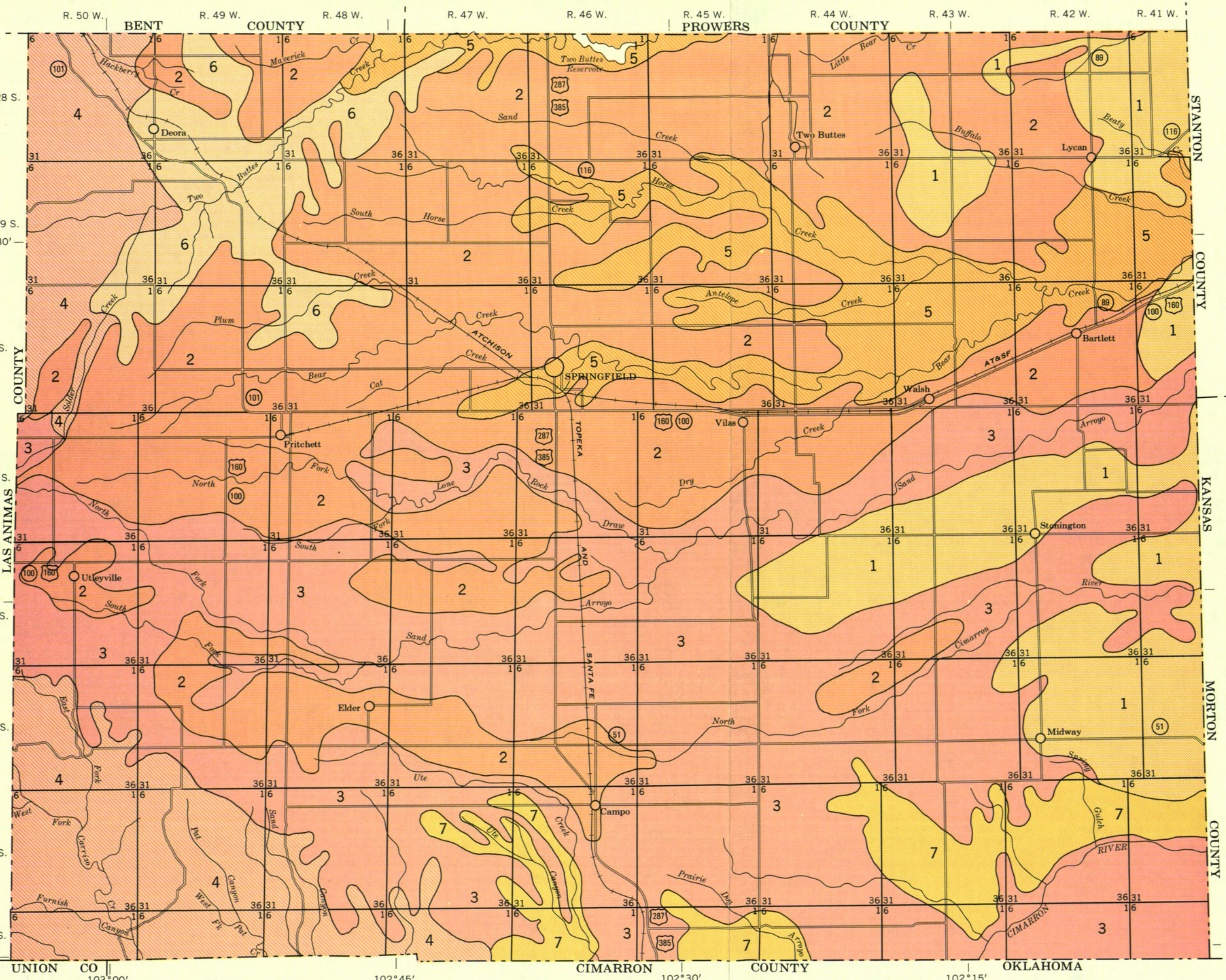
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
COLORADO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BACA COUNTY, COLORADO



1 0 1 2 3 4 5 Miles
Scale 1:316 800

N

SOIL ASSOCIATIONS*

1 Richfield-Ulysses-Norka association: Deep, nearly level to gently undulating silt loams on loess uplands

2 Baca-Wiley association: Deep, nearly level to sloping clay loams and loams on loess uplands

3 Vona-Manter-Dalhart association: Deep, nearly level to gently undulating sandy loams and loamy sands on uplands

4 Travessilla-Kim association: Shallow, strongly sloping stony sandy loams on sandstone breaks and bluffs and deep, dominantly gently sloping loams on bordering foot slopes

5 Wiley-Potter association: Deep and shallow, moderately sloping to strongly sloping loams and gravelly loams on uplands

6 Minnequa-Manvel-Penrose association: Deep to shallow, nearly level to sloping loams on limestone and marl uplands

7 Otero-Potter association: Deep and shallow, undulating and rolling loams and gravelly loams on uplands

* Texture in the name of the associations refers to the surface layer of the major soils unless indicated otherwise.

This map is for general planning. It shows only the major soils and does not contain sufficient detail for operational planning.

INDEX TO MAP SHEETS

BACA COUNTY, COLORADO

Scale 1:316800

1 0 1 2 3 4 5 Miles

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, or D, shows the class of slope. Most symbols without a slope letter are those of nearly level soils or land types, but some are for soils or land types that have a considerable range in slope. A final number, 2, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ap	Apache stony loam
BaA	Baca clay loam, 0 to 1 percent slopes
BaB	Baca clay loam, 1 to 3 percent slopes
BaC	Baca clay loam, 3 to 5 percent slopes
Bk	Bankard sand
Ca	Campo clay loam
Cn	Capulin loam
CoA	Colby silt loam, 0 to 1 percent slopes
CoB	Colby silt loam, 1 to 3 percent slopes
CoD	Colby silt loam, 3 to 9 percent slopes
CtA	Colby silt loam, terrace, 0 to 2 percent slopes
DaA	Dalhart loamy sand, 0 to 1 percent slopes
DaB	Dalhart loamy sand, 1 to 3 percent slopes
DhA	Dalhart sandy loam, 0 to 1 percent slopes
DhB	Dalhart sandy loam, 1 to 3 percent slopes
Du	Dune land
Gb	Glenberg sandy loam
GoA	Goshen loam, 0 to 1 percent slopes
GoB	Goshen loam, 1 to 3 percent slopes
Gr	Gravelly land
HaA	Harbord loam, 0 to 1 percent slopes
HaB	Harbord loam, 1 to 3 percent slopes
HaC	Harbord loam, 3 to 5 percent slopes
HrC	Harvey loam, 1 to 5 percent slopes
KmD	Kim loam, 0 to 9 percent slopes
MaA	Manter and Vona sandy loams, 0 to 1 percent slopes
MaB	Manter and Vona sandy loams, 1 to 3 percent slopes
McA	McCook loam, 0 to 1 percent slopes
McB	McCook loam, 1 to 3 percent slopes
Mm	Minnequa-Manvel complex
Nu	Nunn clay loam
OeB	Otero sandy loam, 0 to 3 percent slopes
OeD	Otero sandy loam, 3 to 9 percent slopes
Op	Otero-Potter complex
Pe	Penrose channery loam
Po	Potter gravelly loam
RcA	Richfield silt loam, 0 to 1 percent slopes
Ro	Rough stony land
Th	Thedalund silty clay loam
Tn	Tivoli sand
To	Tivoli-Dune land complex
Tr	Travessilla stony sandy loam
UnA	Ulysses and Norka silt loams, 0 to 1 percent slopes
UnB	Ulysses and Norka silt loams, 1 to 3 percent slopes
VnB	Vona loamy sand, 0 to 3 percent slopes
VoC	Vona sandy loam, 3 to 5 percent slopes
Vr2	Vona soils, eroded
Wa	Wages loam
WlA	Wiley loam, 0 to 1 percent slopes
WlB	Wiley loam, 1 to 3 percent slopes
WlC	Wiley loam, 3 to 5 percent slopes
WlD	Wiley loam, 5 to 9 percent slopes
Ws2	Wiley soils, eroded

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Tunnel

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

BOUNDARIES

- National or state
- County
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Unclassified

Canals and ditches (CANAL)

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Alluvial fan

Drainage end

RELIEF

Escarpments
- Bedrock
- Other

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully

BACA COUNTY, COLORADO NO. 1

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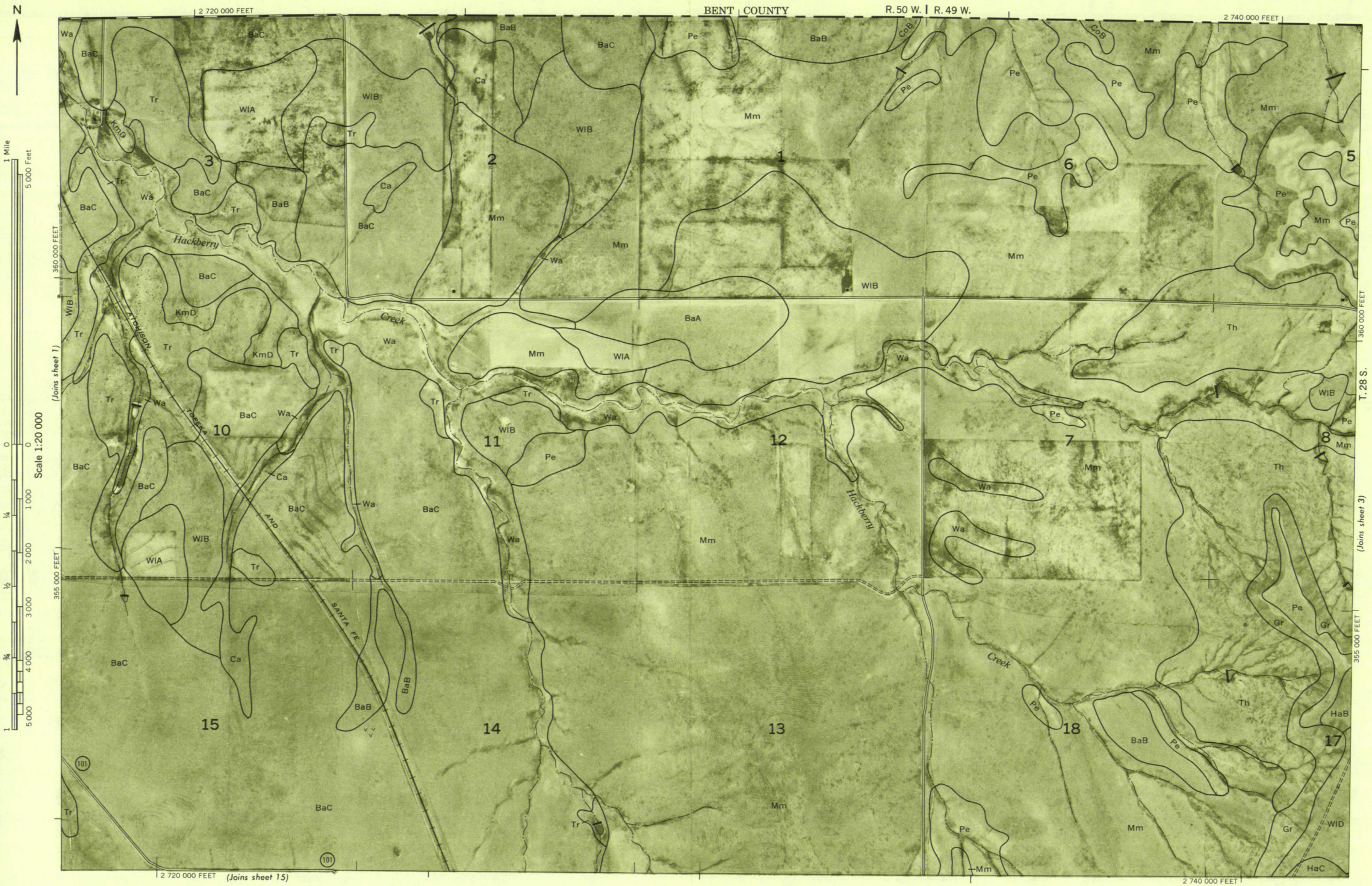
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 2



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BACA COUNTY, COLORADO NO. 2

BACA COUNTY, COLORADO NO.3

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BACA COUNTY, COLORADO — SHEET NUMBER 4

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BACA COUNTY, COLORADO NO. 4

BACA COUNTY, COLORADO — SHEET NUMBER 5

5

BACA COUNTY, COLORADO NO. 5

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Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 6

6

N

Scale 1:20 000

1 Mile | 5 000 Feet

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

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BACA COUNTY, COLORADO NO. 6

7

BACA COUNTY, COLORADO NO. 7

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Land division corners are approximately positioned on this map.

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9

N

Scale 1:20 000

1 Mile

5 000 Feet

0 1000 2000 3000 4000 5000

0 ¼ ½ ¾ 1

BACA COUNTY, COLORADO NO. 9

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Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

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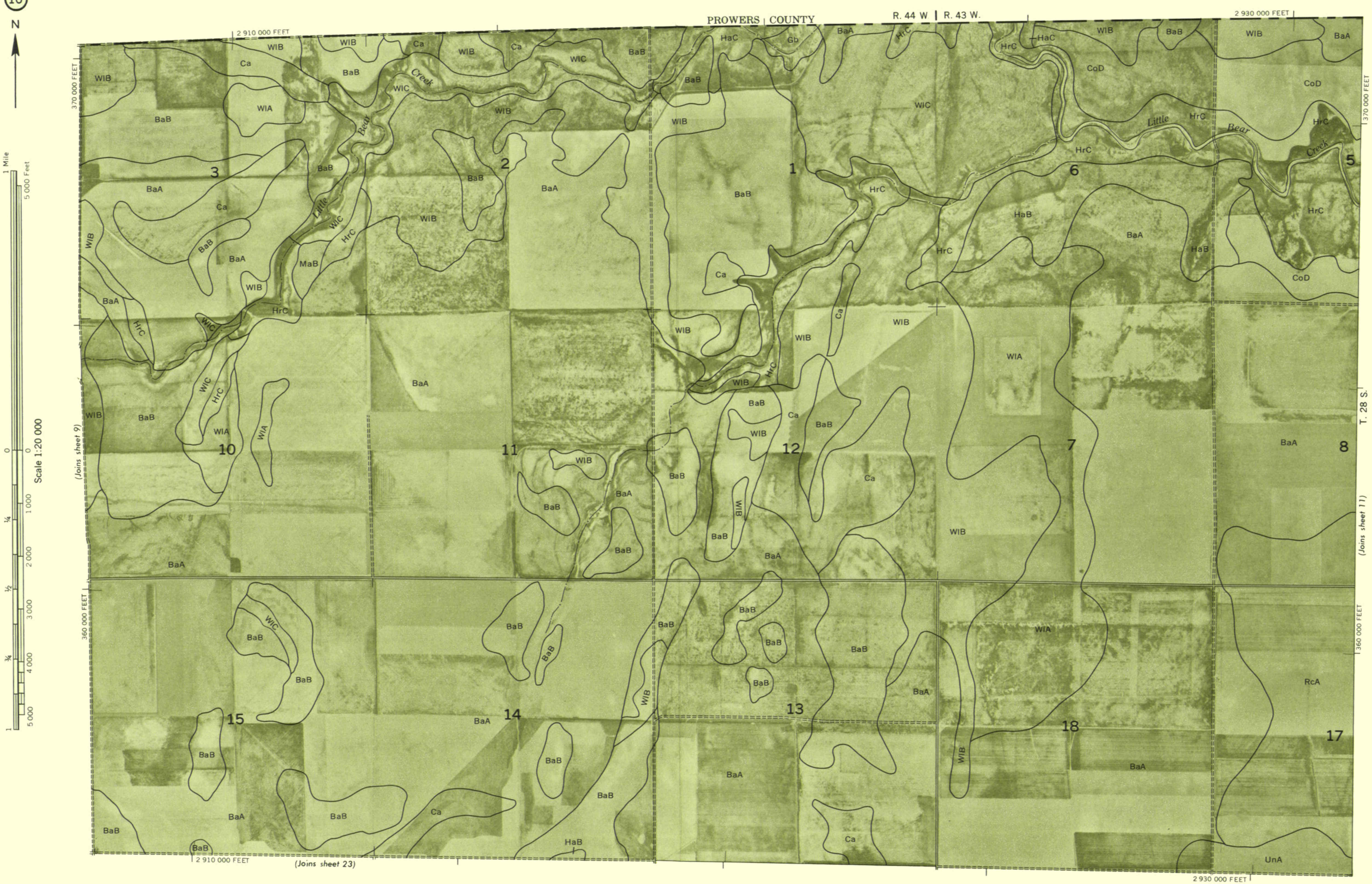
10



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

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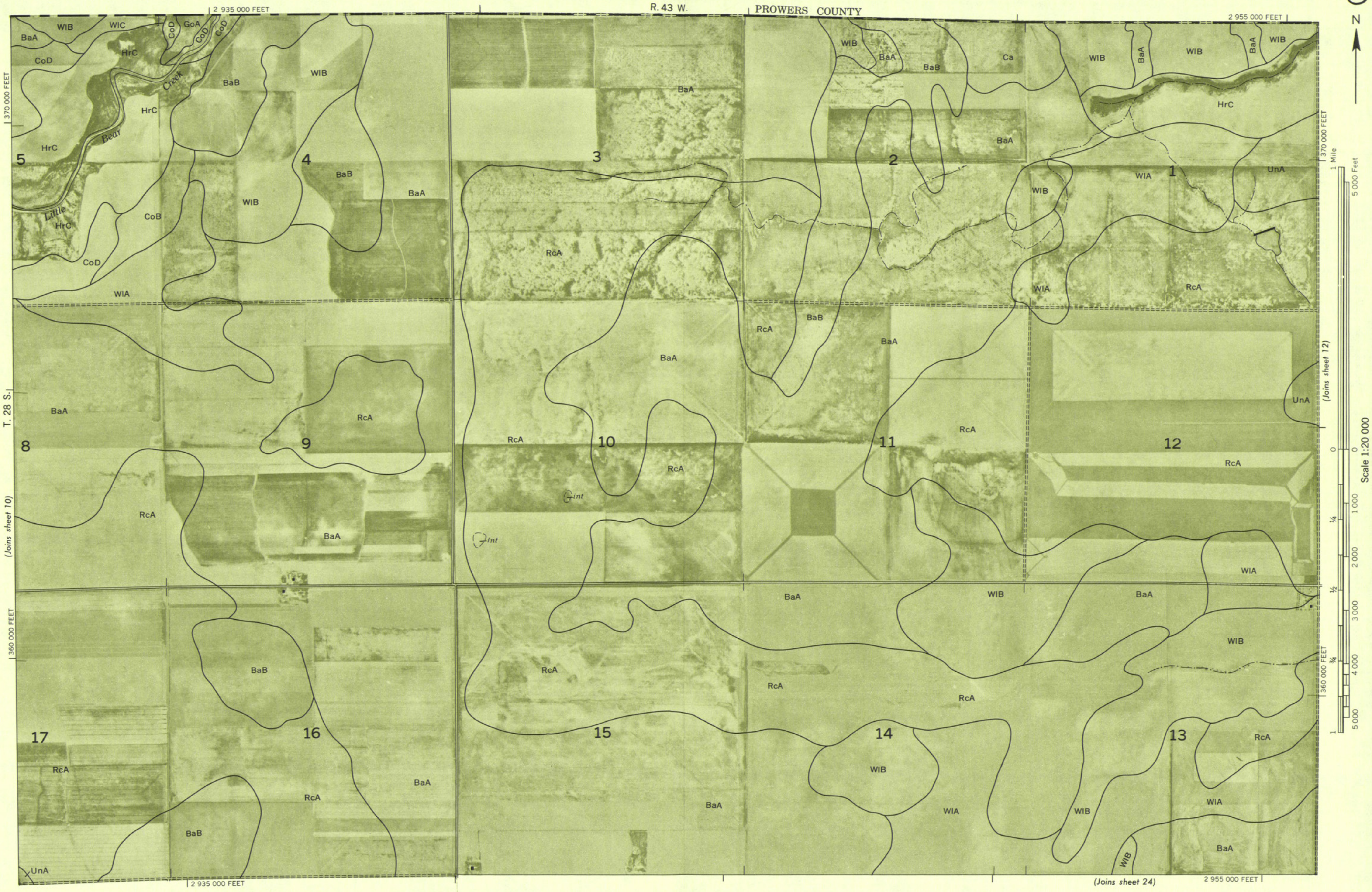

BACA COUNTY, COLORADO NO. 11

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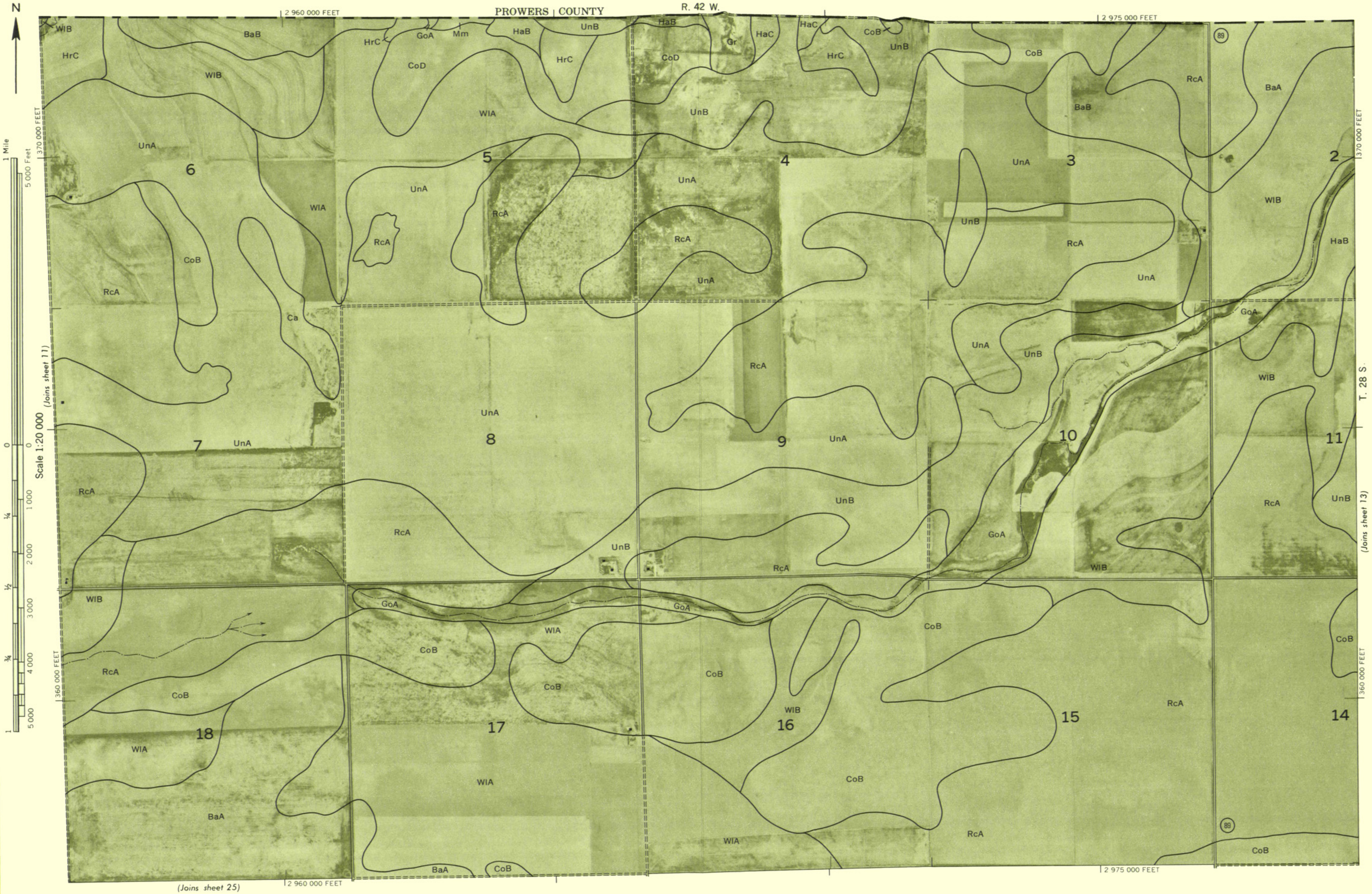
Land division corners are approximately positioned on this map.

12

BACA COUNTY, COLORADO — SHEET NUMBER 12



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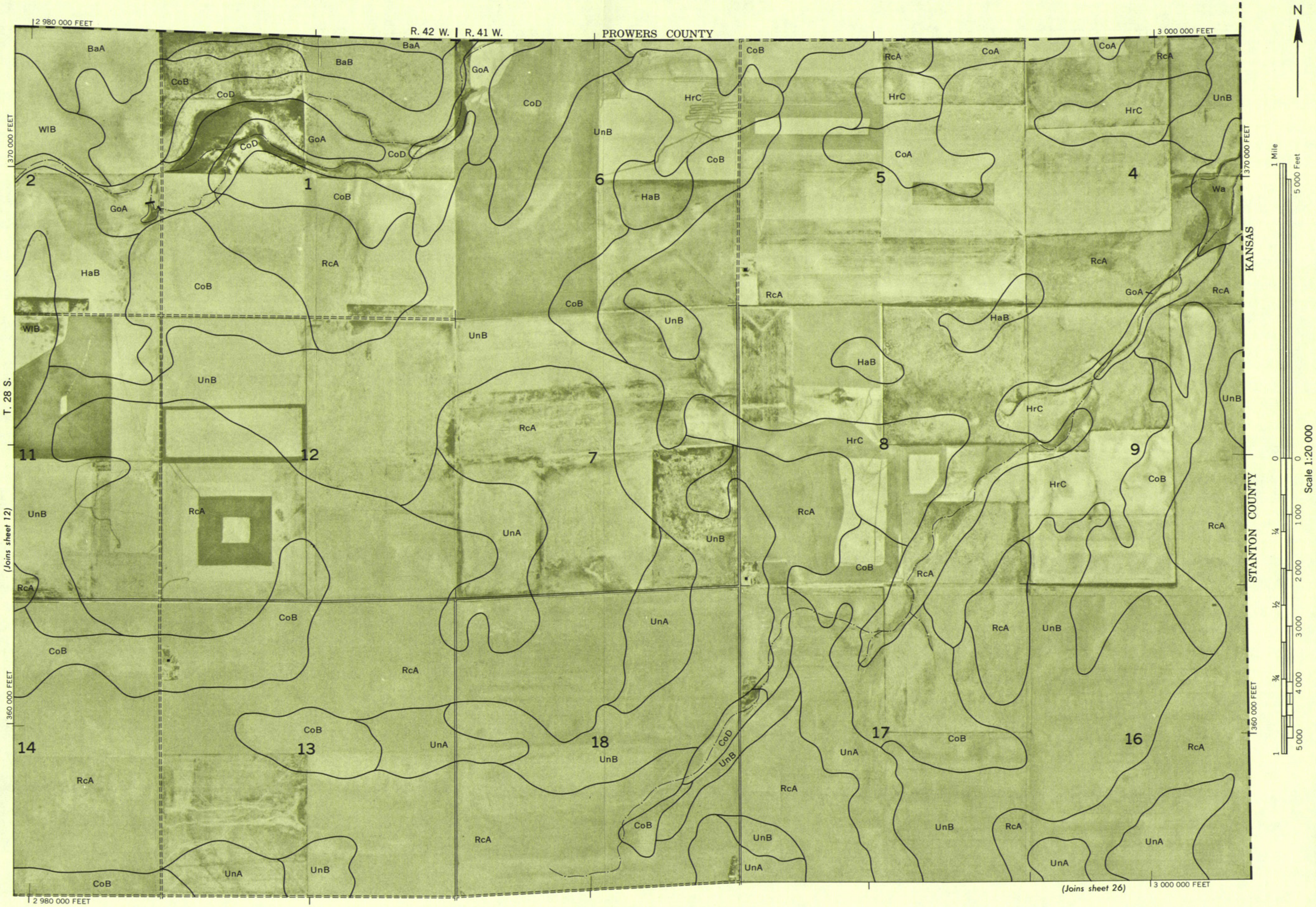
BACA COUNTY COLORADO NO.12



BACA COUNTY, COLORADO NO. 13

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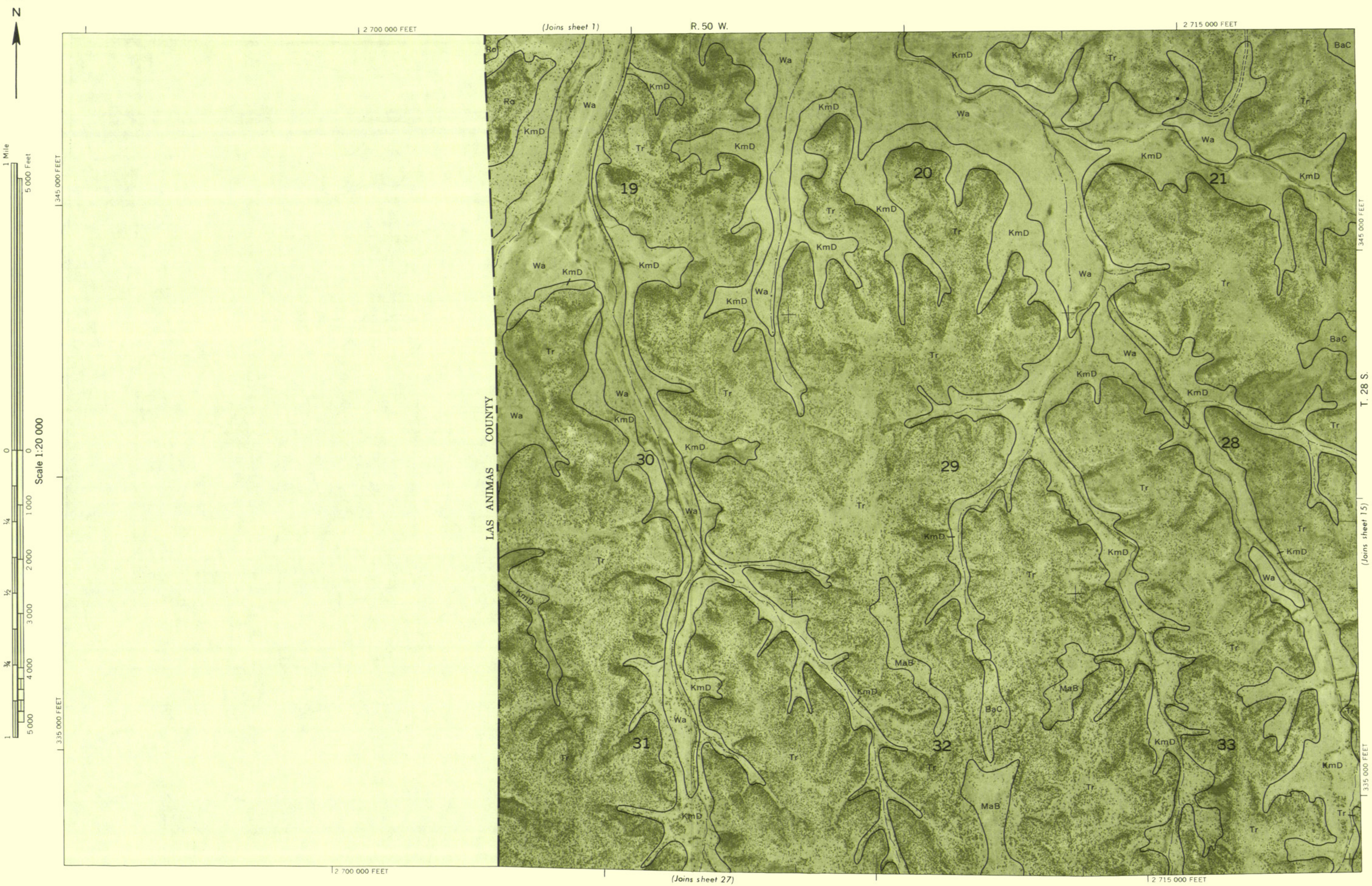
BACA COUNTY, COLORADO — SHEET NUMBER 14



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Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone, 1927 North American Datum.

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BACA COUNTY, COLORADO NO. 14

BACA COUNTY, COLORADO NO. 15
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BACA COUNTY, COLORADO — SHEET NUMBER 16

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BACA COUNTY, COLORADO NO. 16

BACA COUNTY, COLORADO NO. 17

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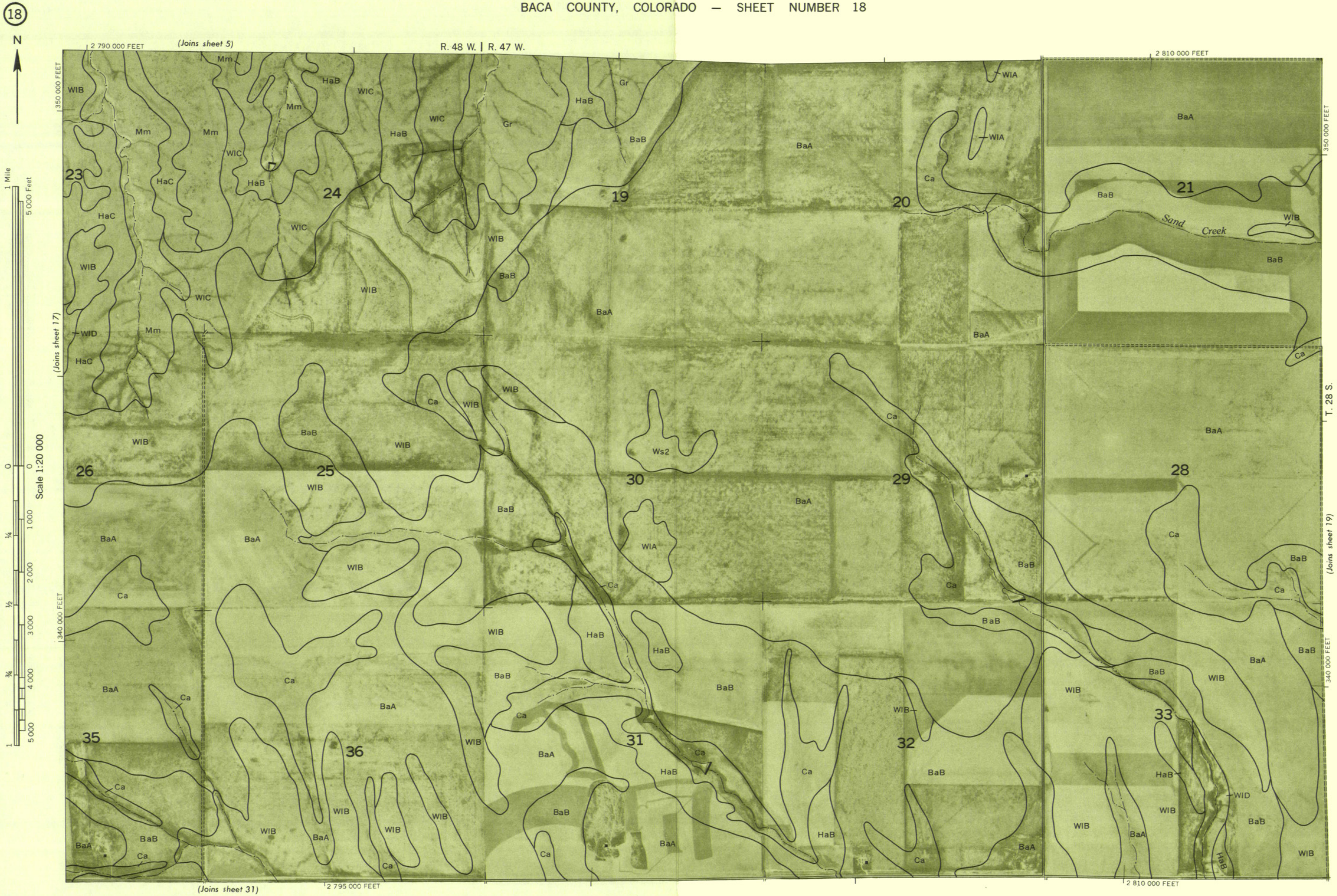

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Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

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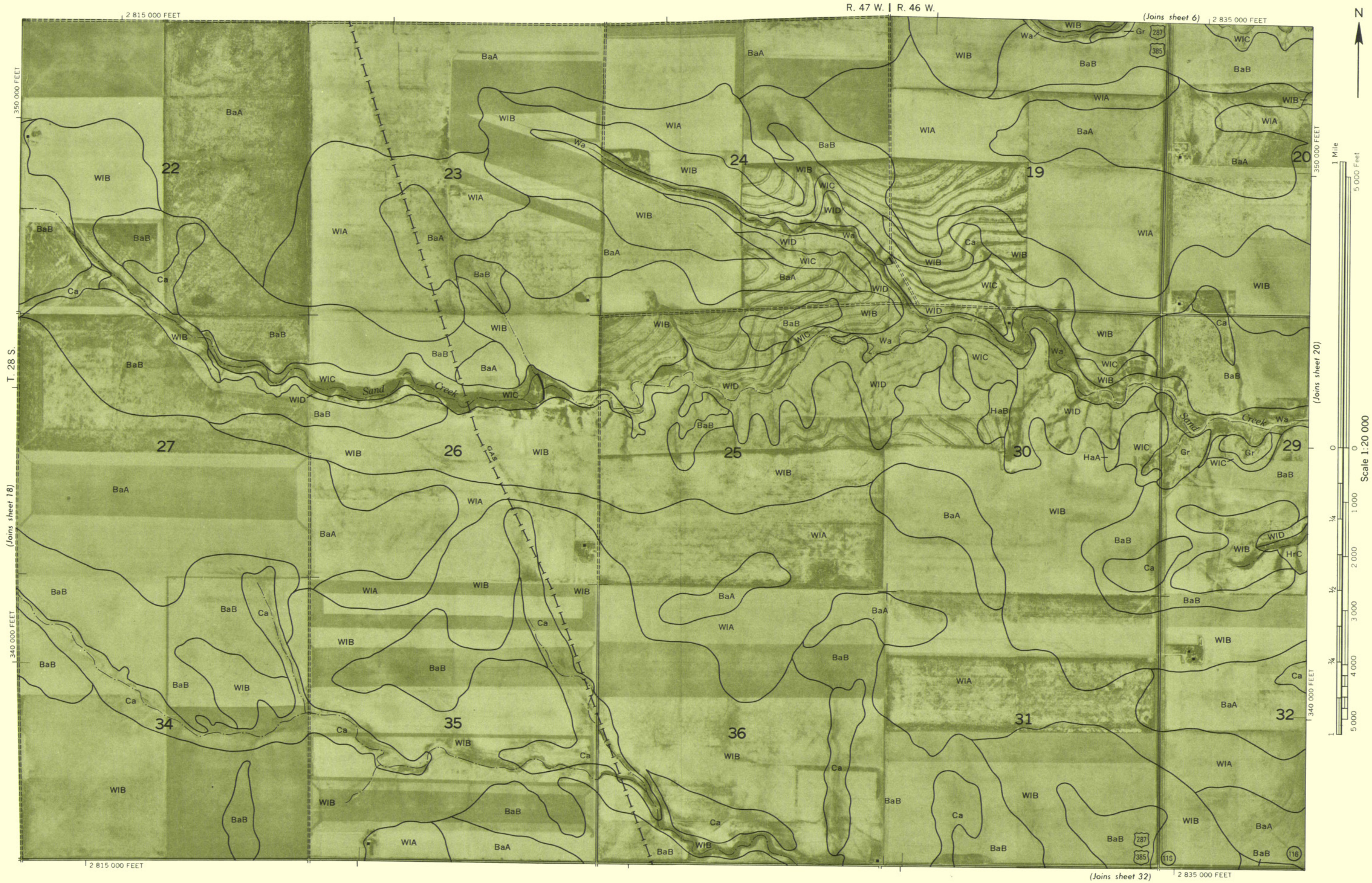
BACA COUNTY, COLORADO NO.18



BACA COUNTY, COLORADO NO. 19

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BACA COUNTY, COLORADO — SHEET NUMBER 20

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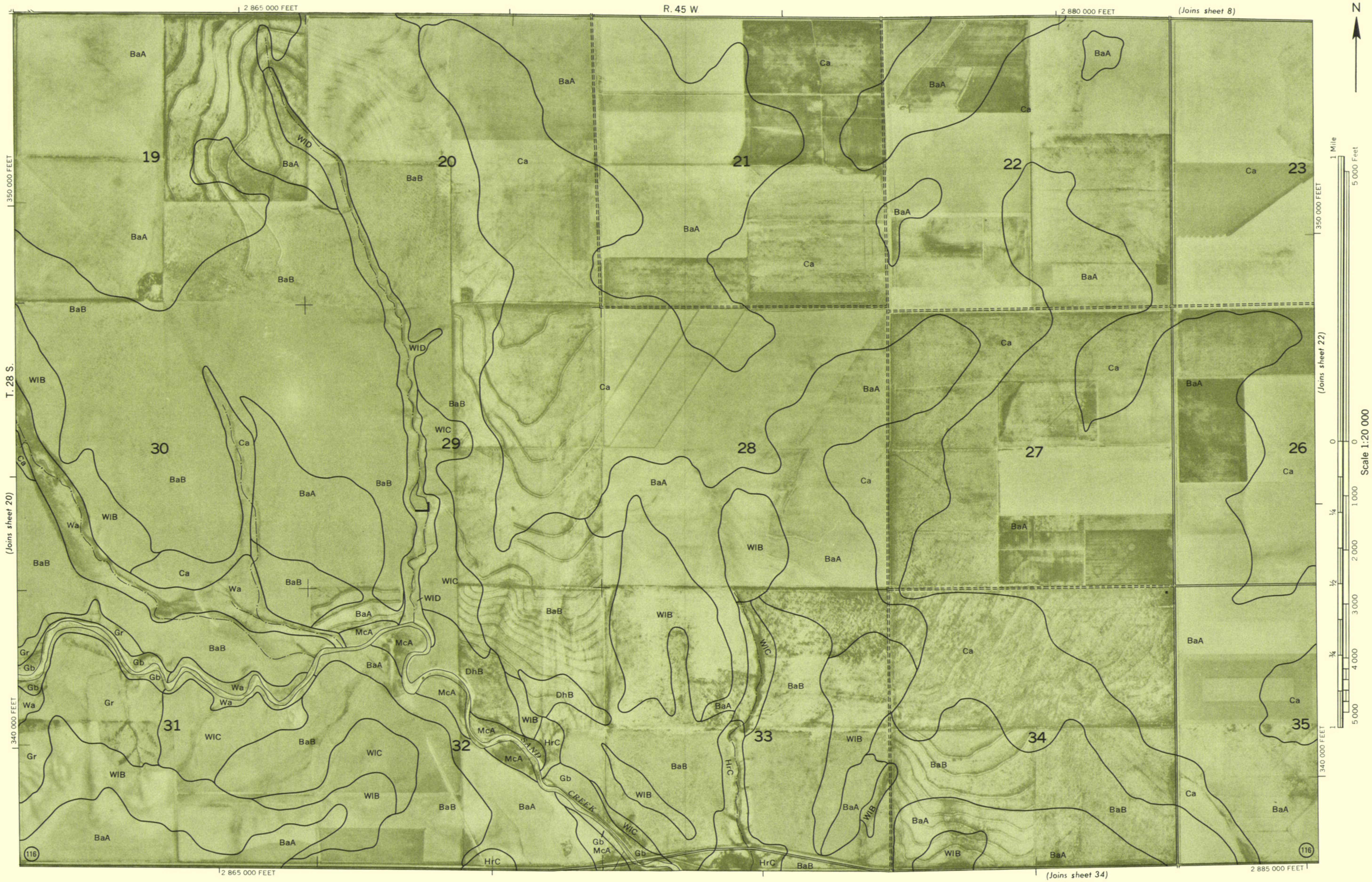
BACA COUNTY, COLORADO NO. 20

BACA COUNTY, COLORADO — SHEET NUMBER 21



BACA COUNTY, COLORADO NO. 21

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Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
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BACA COUNTY, COLORADO — SHEET NUMBER 22

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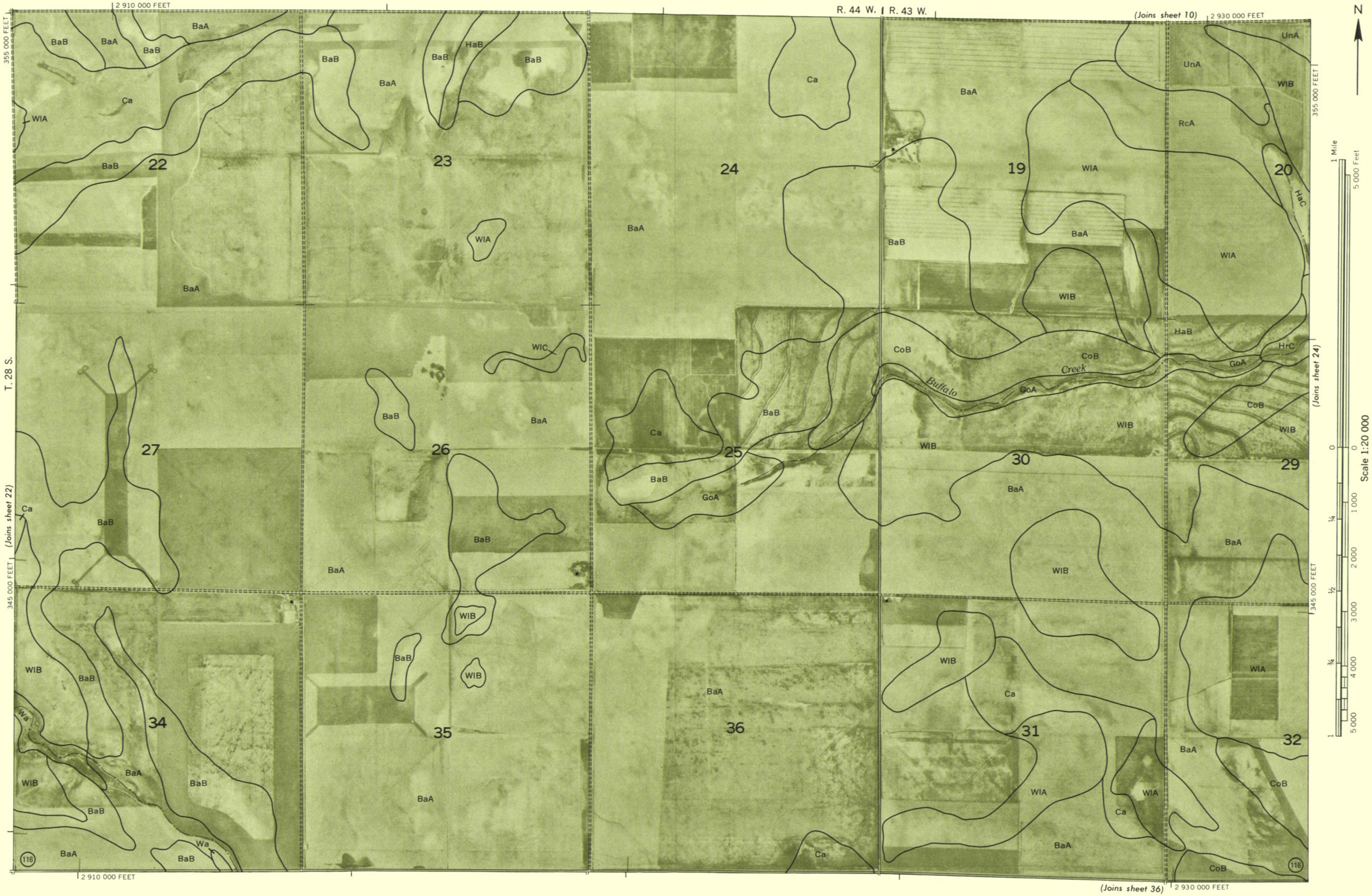
BACA COUNTY, COLORADO NO. 22



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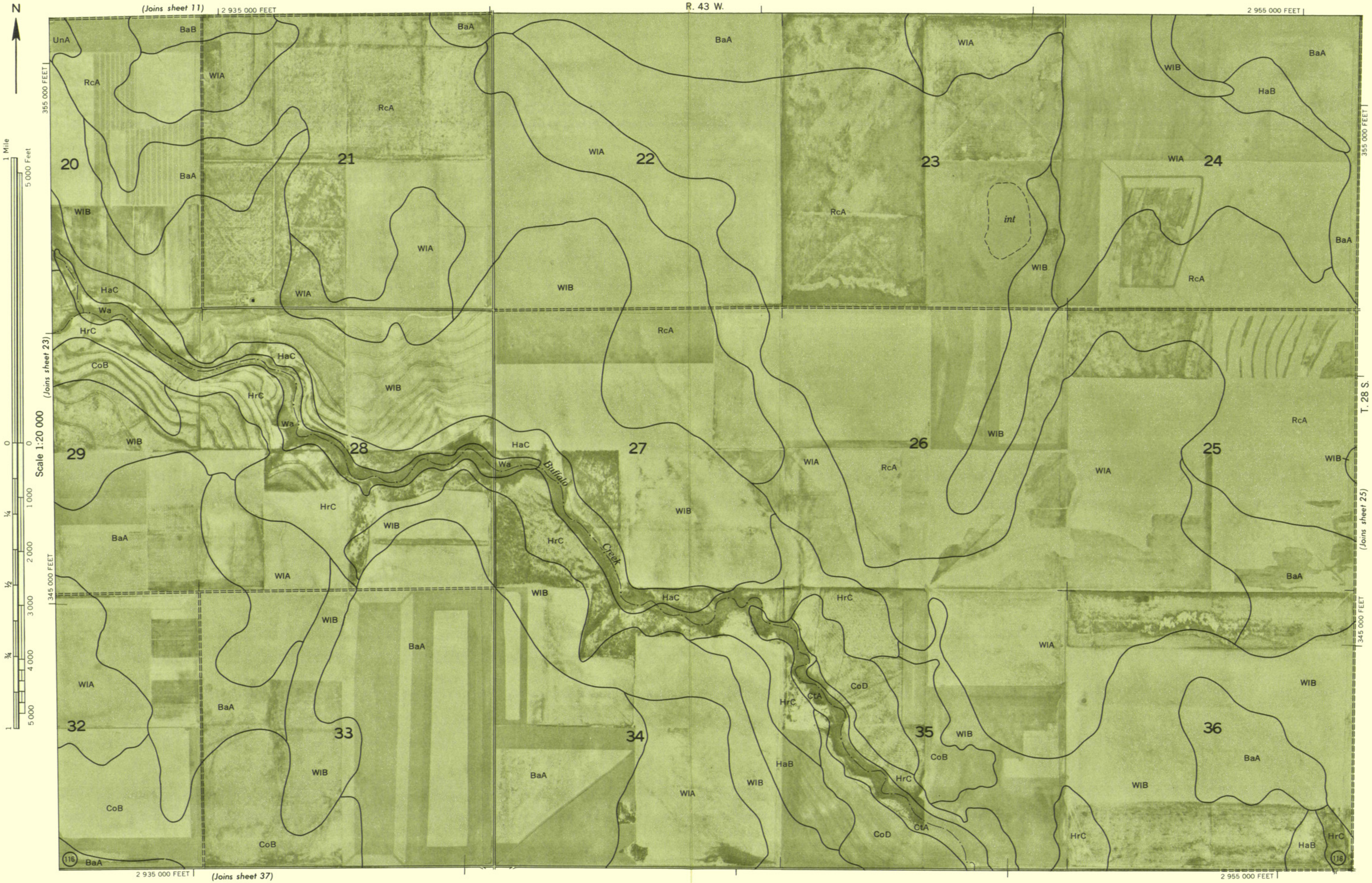

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BACA COUNTY, COLORADO NO. 24

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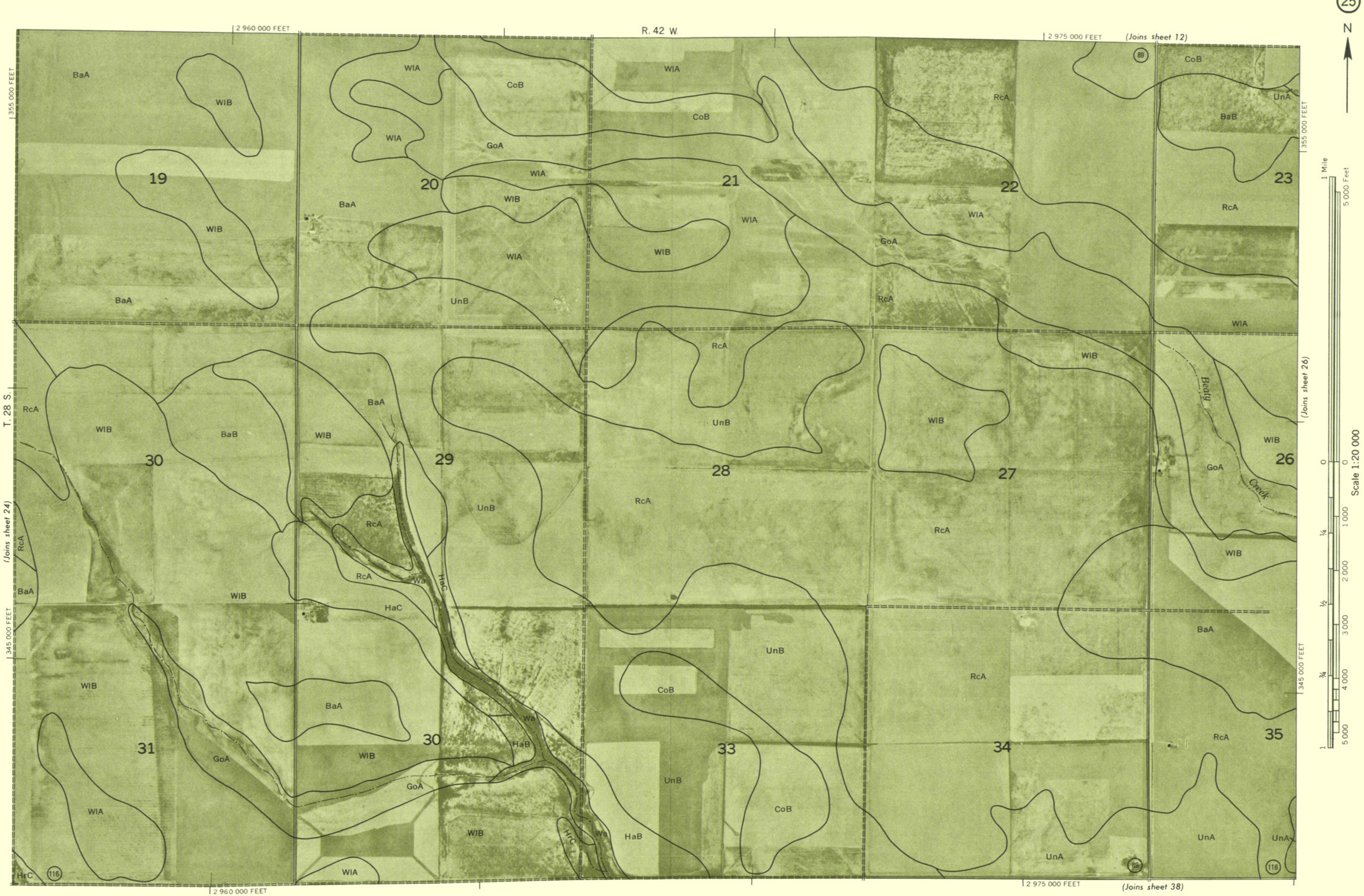

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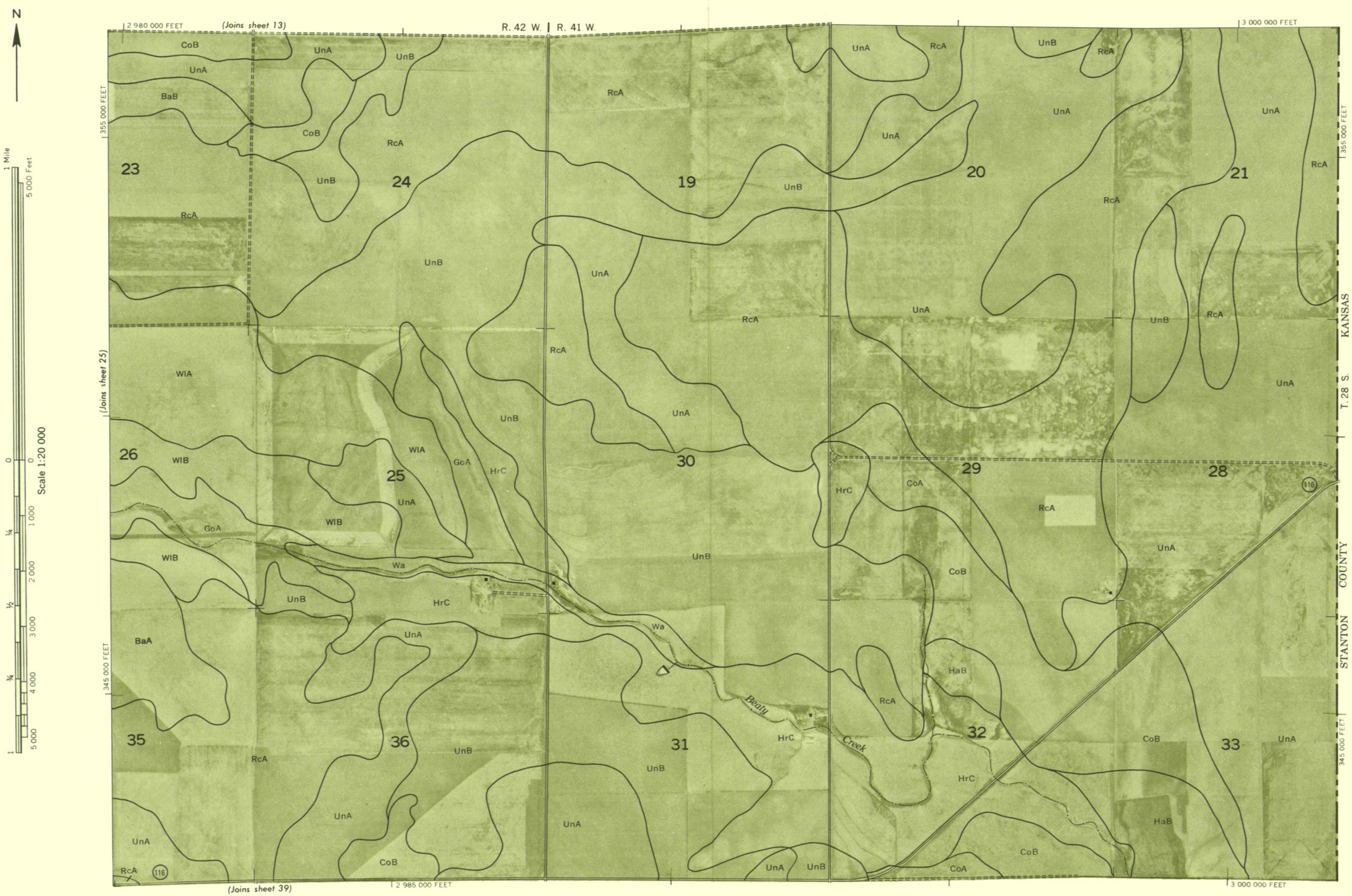

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BACA COUNTY, COLORADO NO. 26

27

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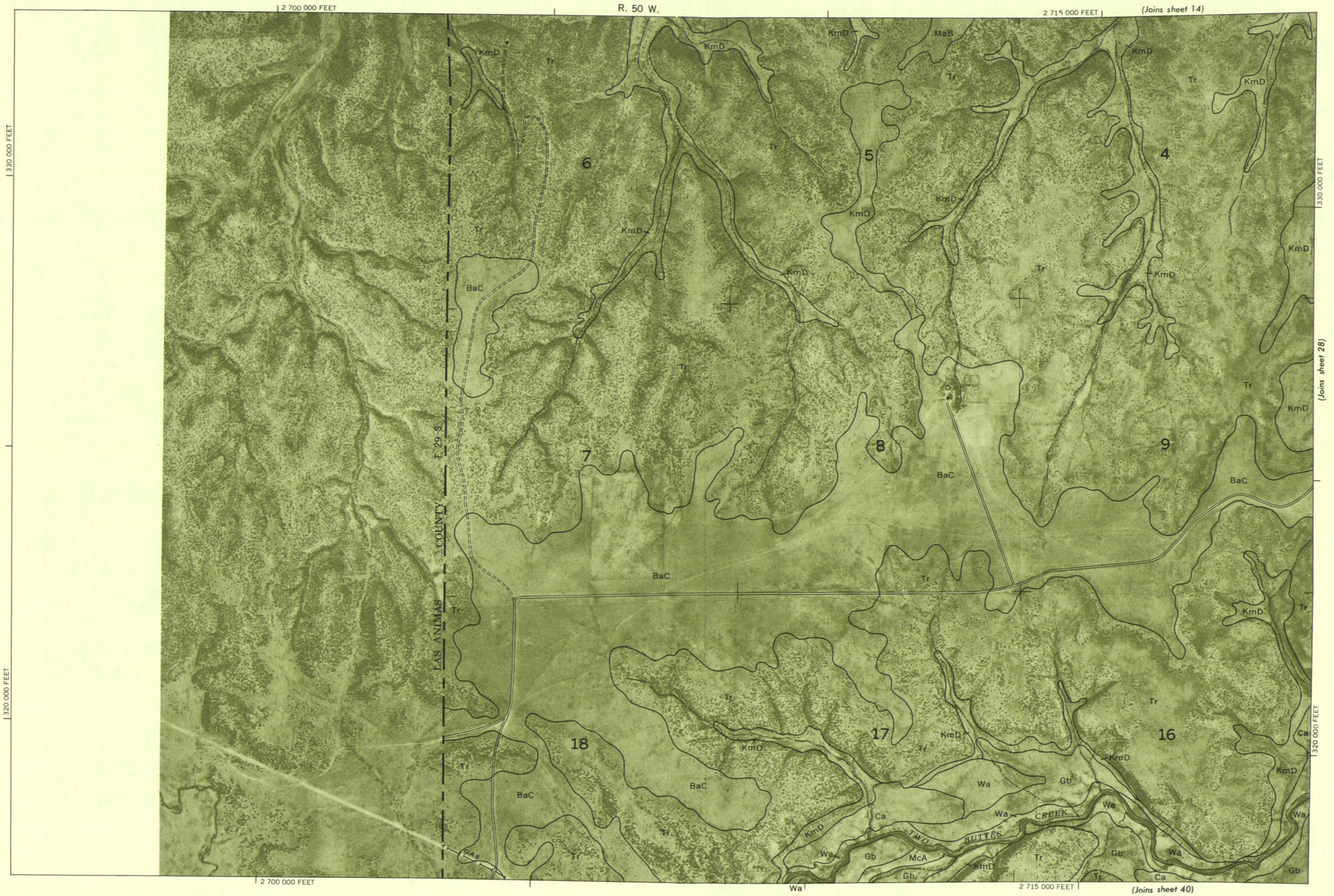

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BACA COUNTY, COLORADO NO. 29

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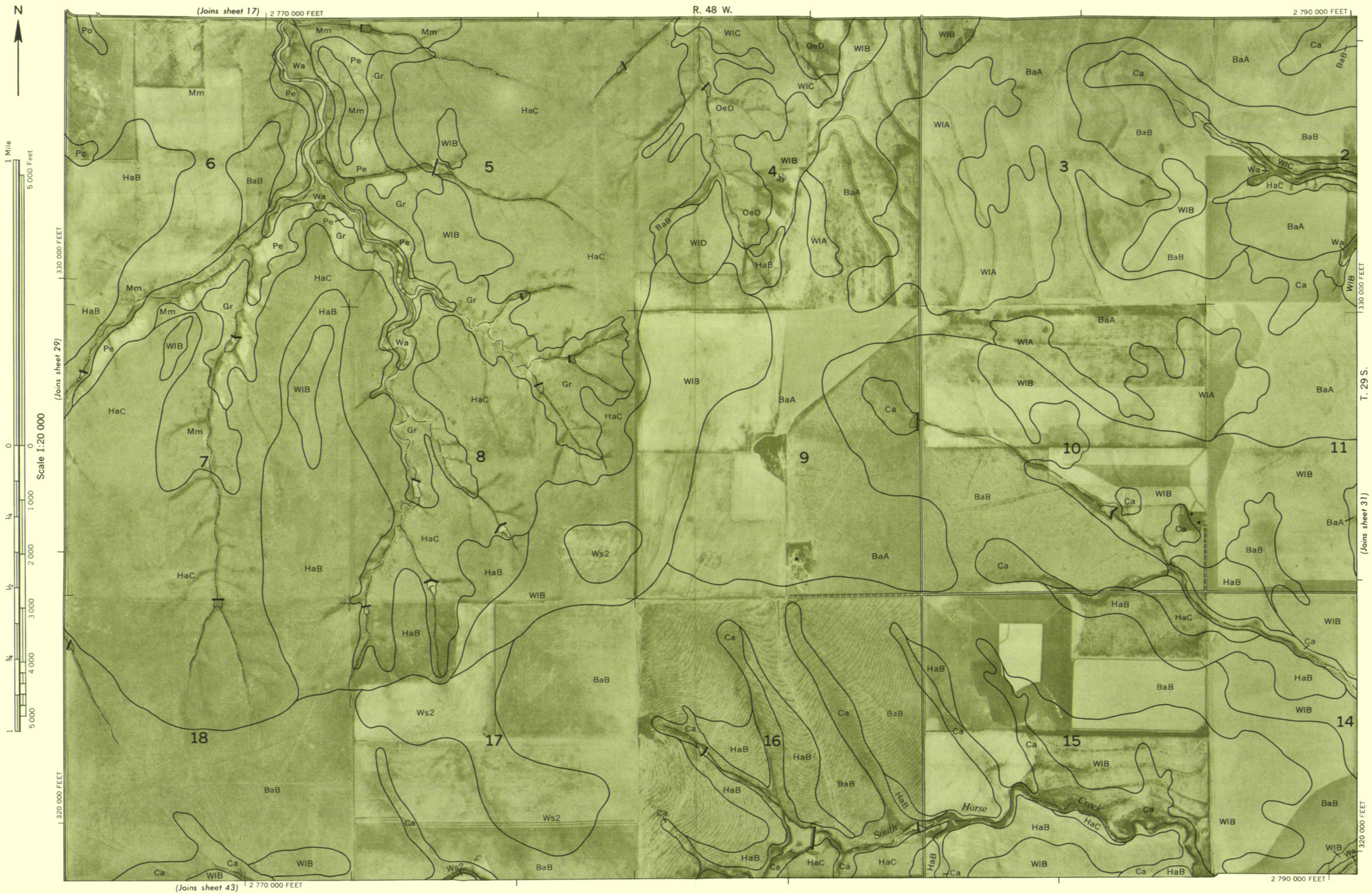
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 30



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 30

BACA COUNTY, COLORADO NO. 31

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 32

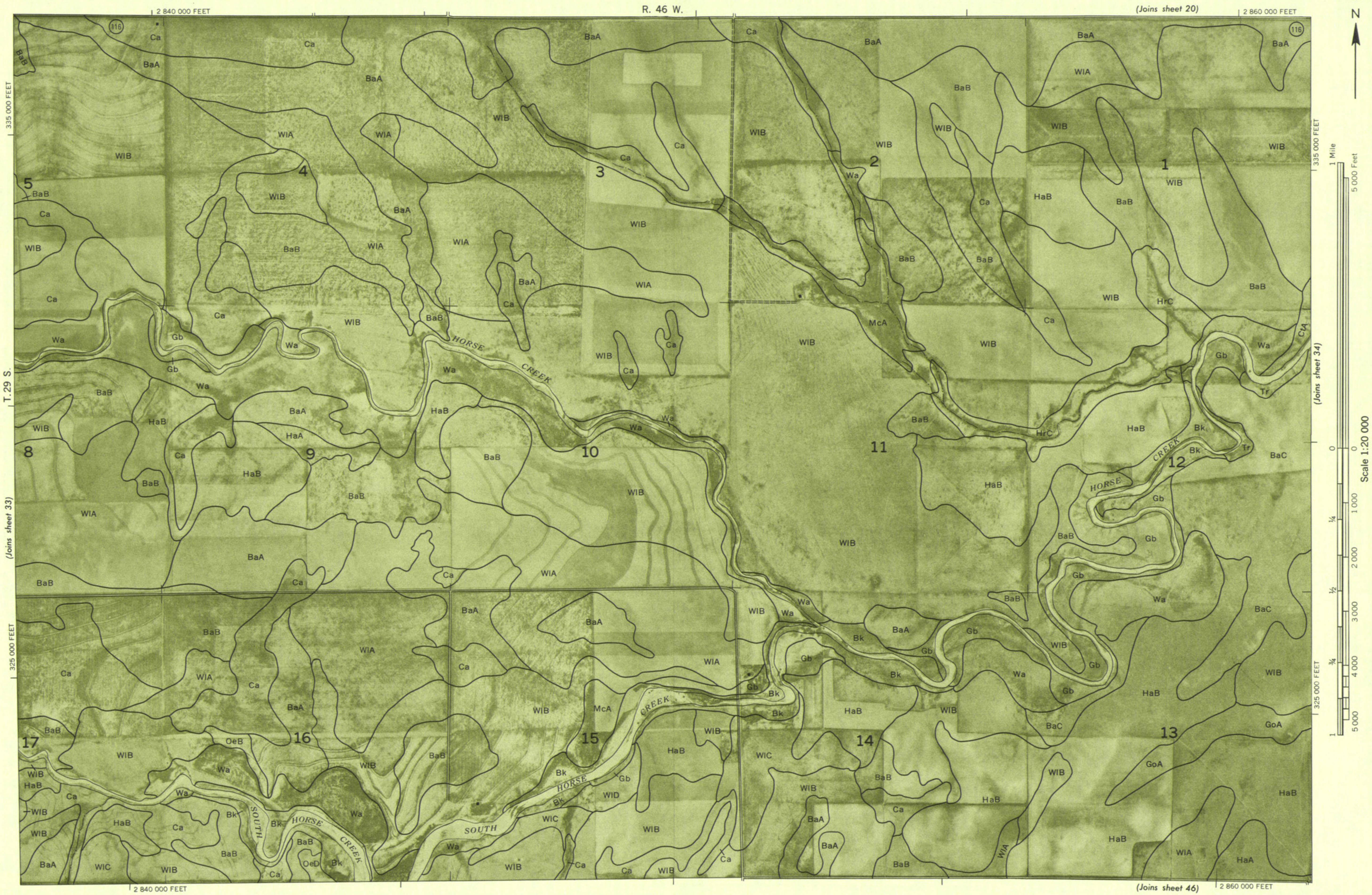
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 32

33



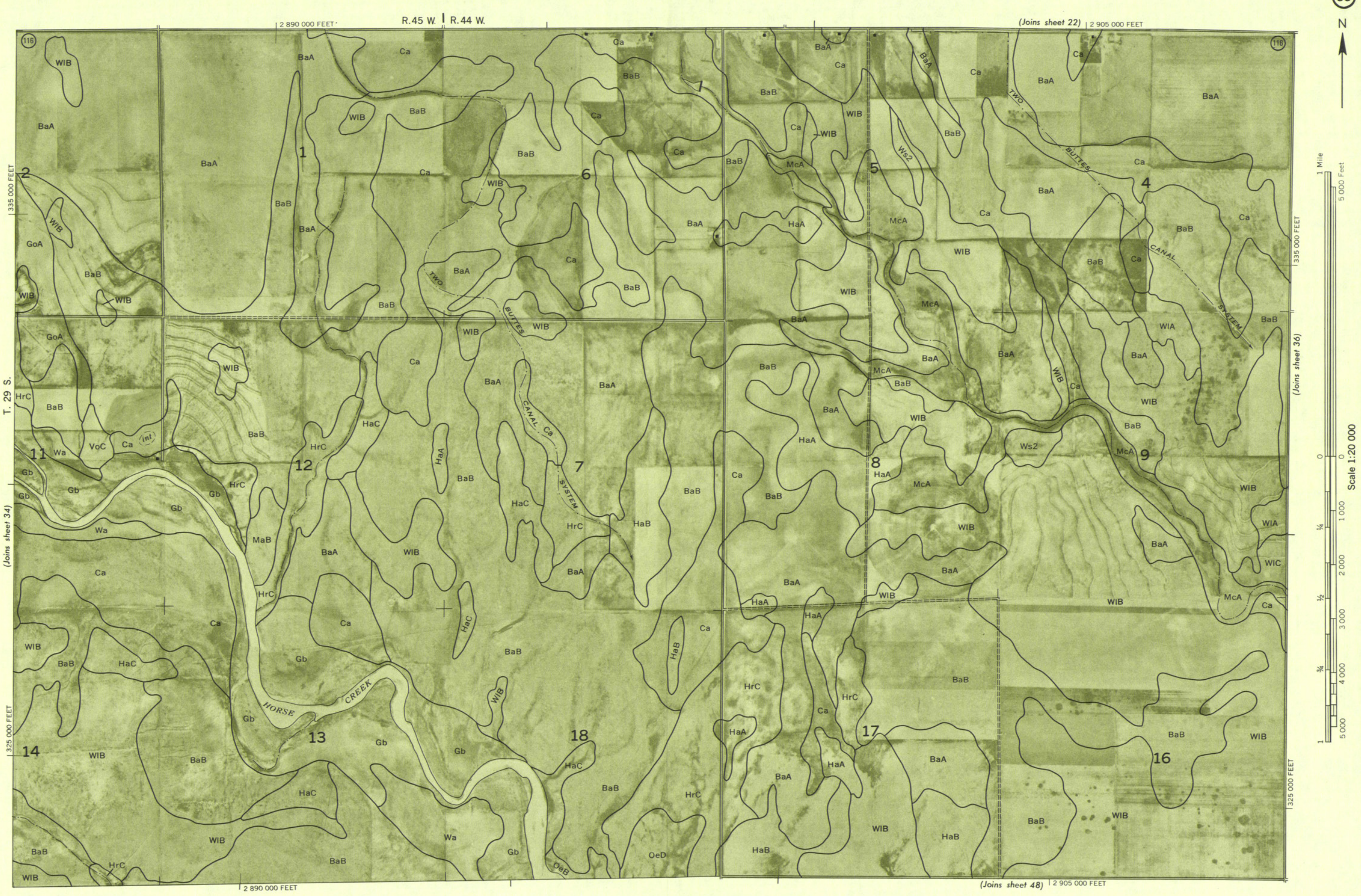
BACA COUNTY, COLORADO NO. 33

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 35

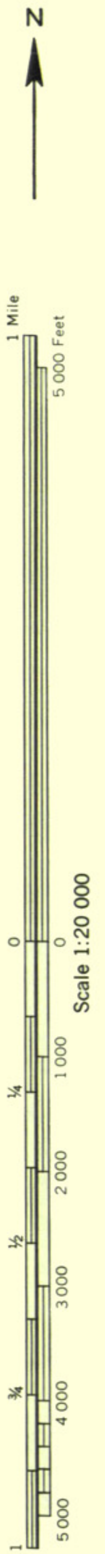
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

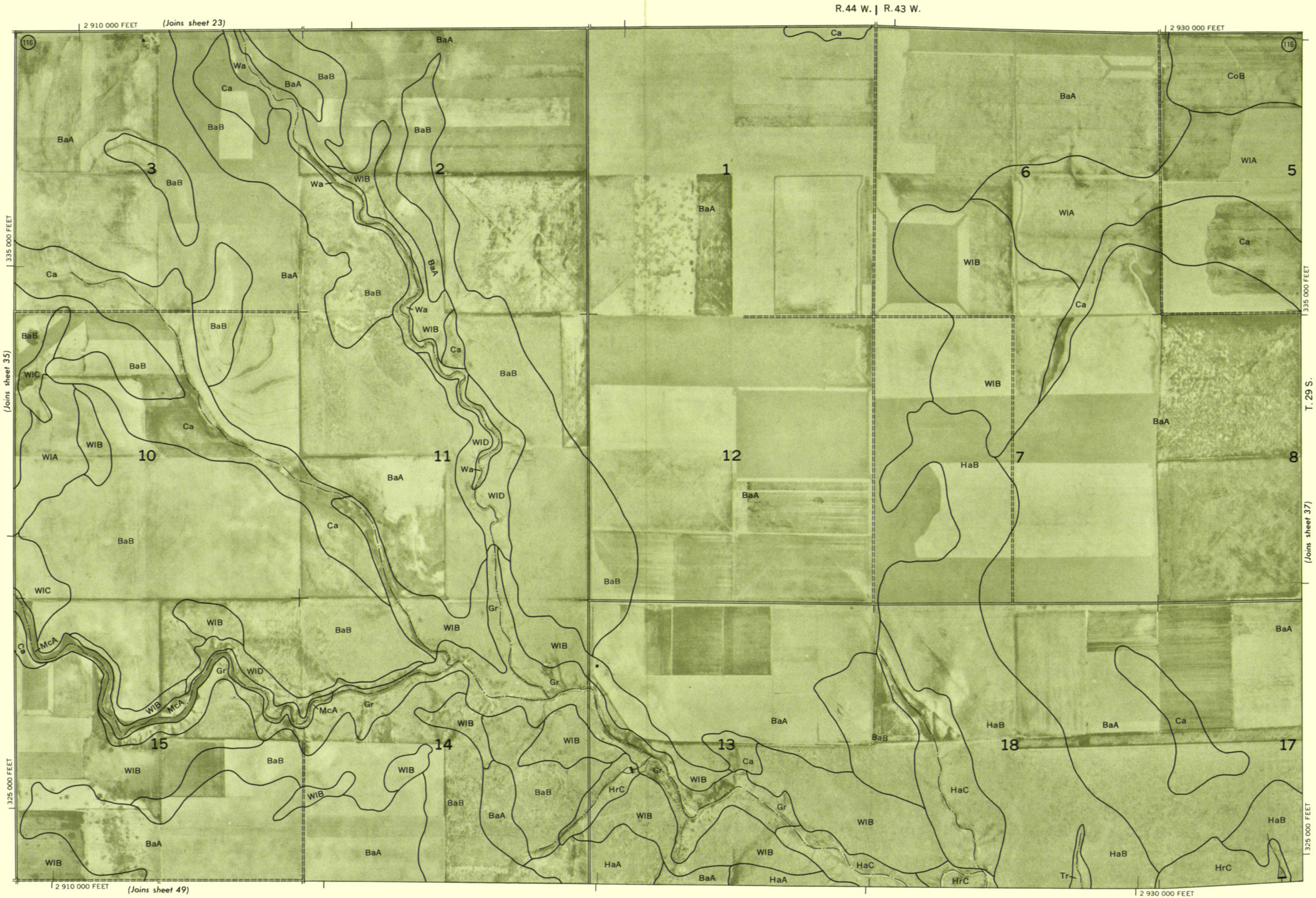
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

(36)

BACA COUNTY, COLORADO — SHEET NUMBER 36





Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 36

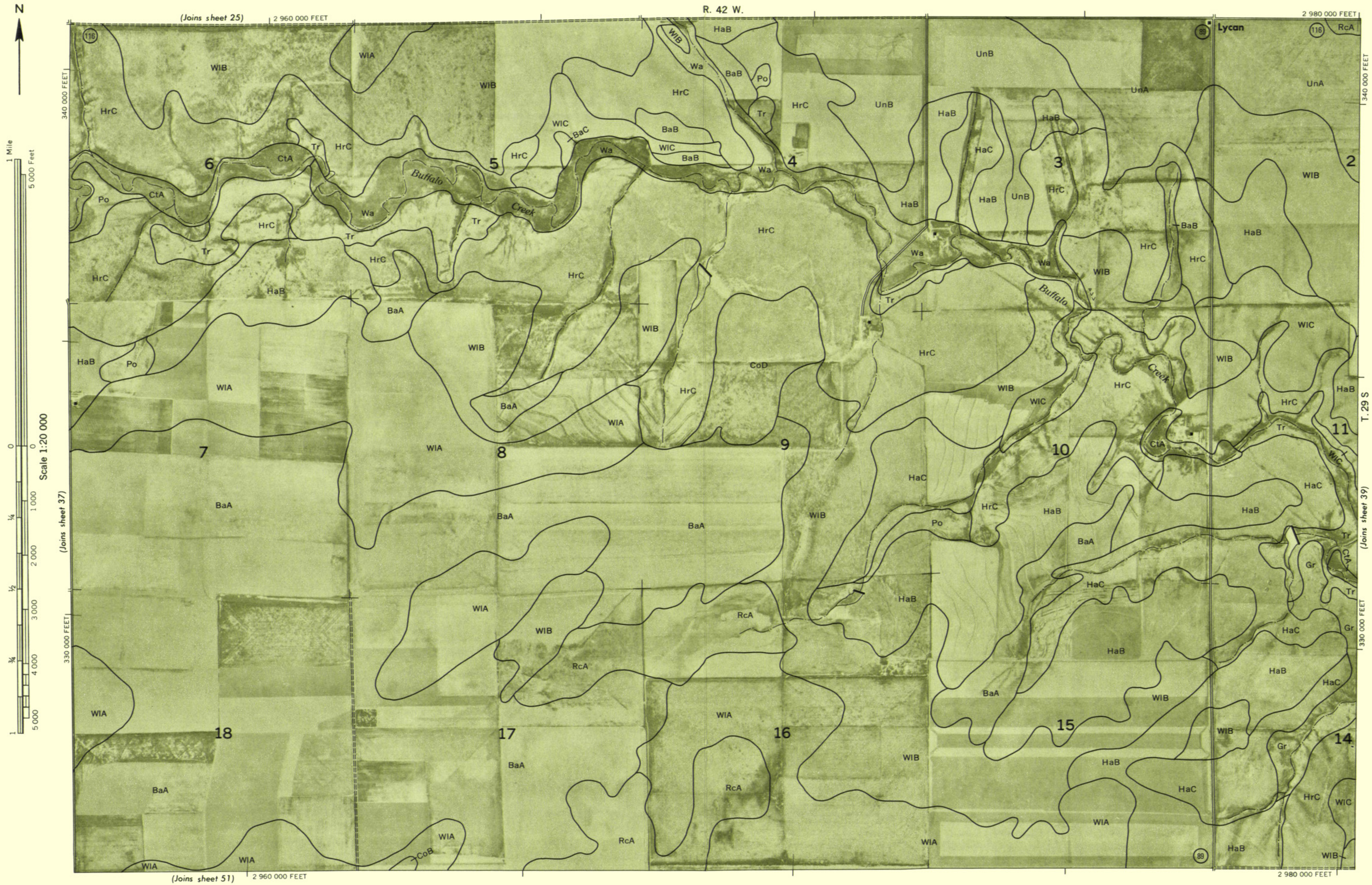
BACA COUNTY, COLORADO NO. 37

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 38



Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

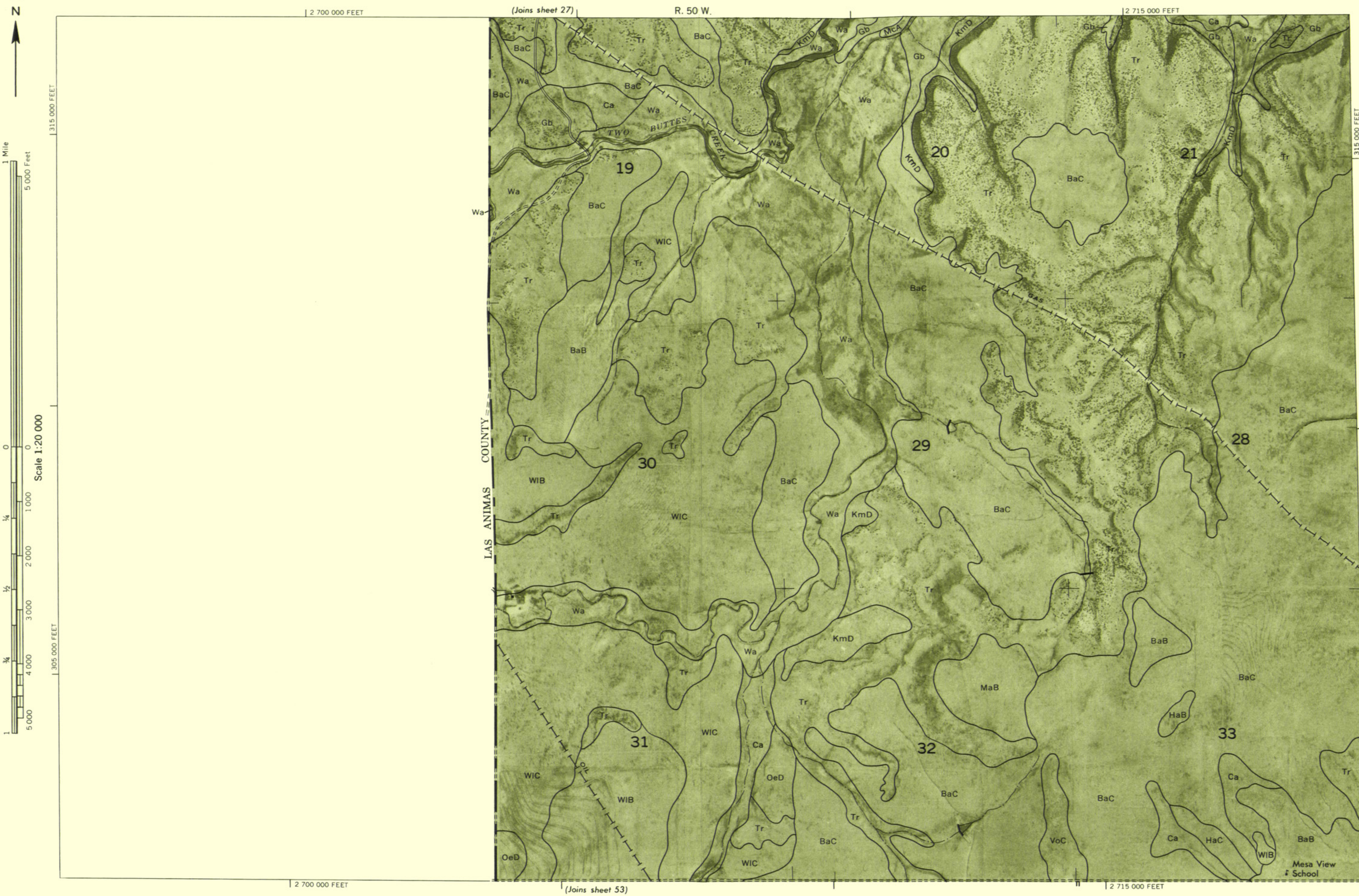
BACA COUNTY, COLORADO NO. 39

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map

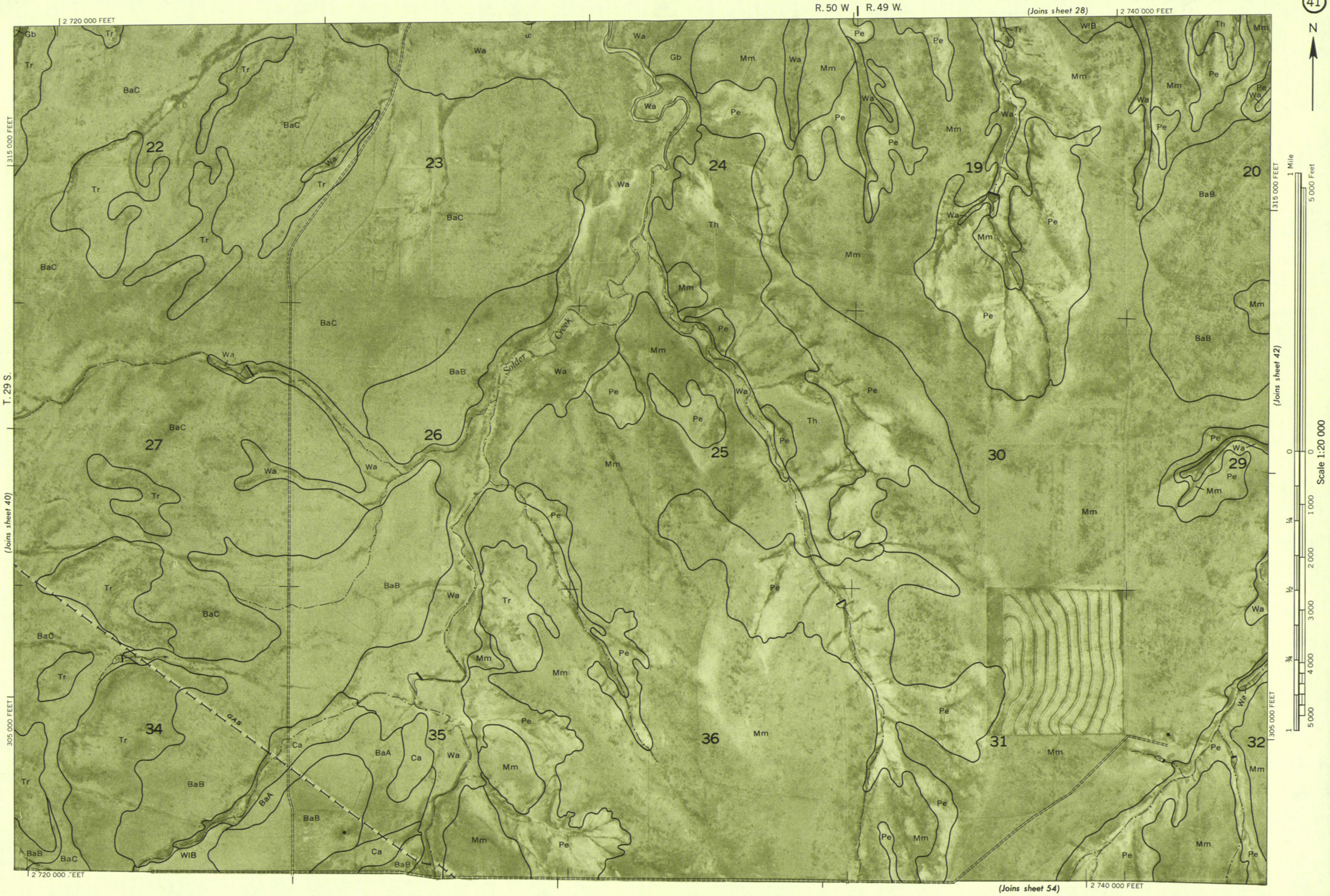
BACA COUNTY, COLORADO — SHEET NUMBER 40



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 41

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone, 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 43

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 44

N

1 Mile
5 000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO — SHEET NUMBER 45

BACA COUNTY, COLORADO NO. 45

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

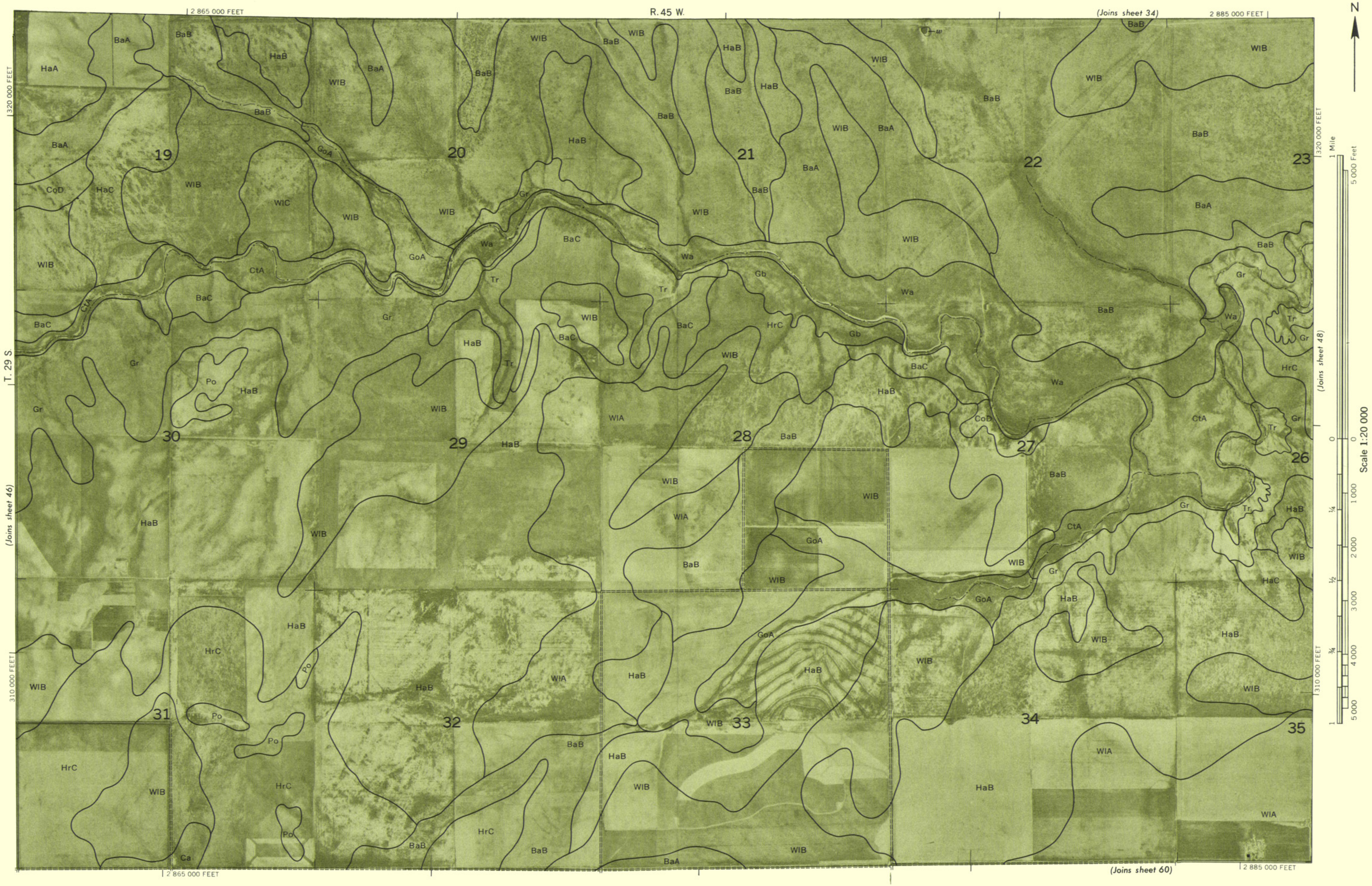
BACA COUNTY, COLORADO — SHEET NUMBER 46

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

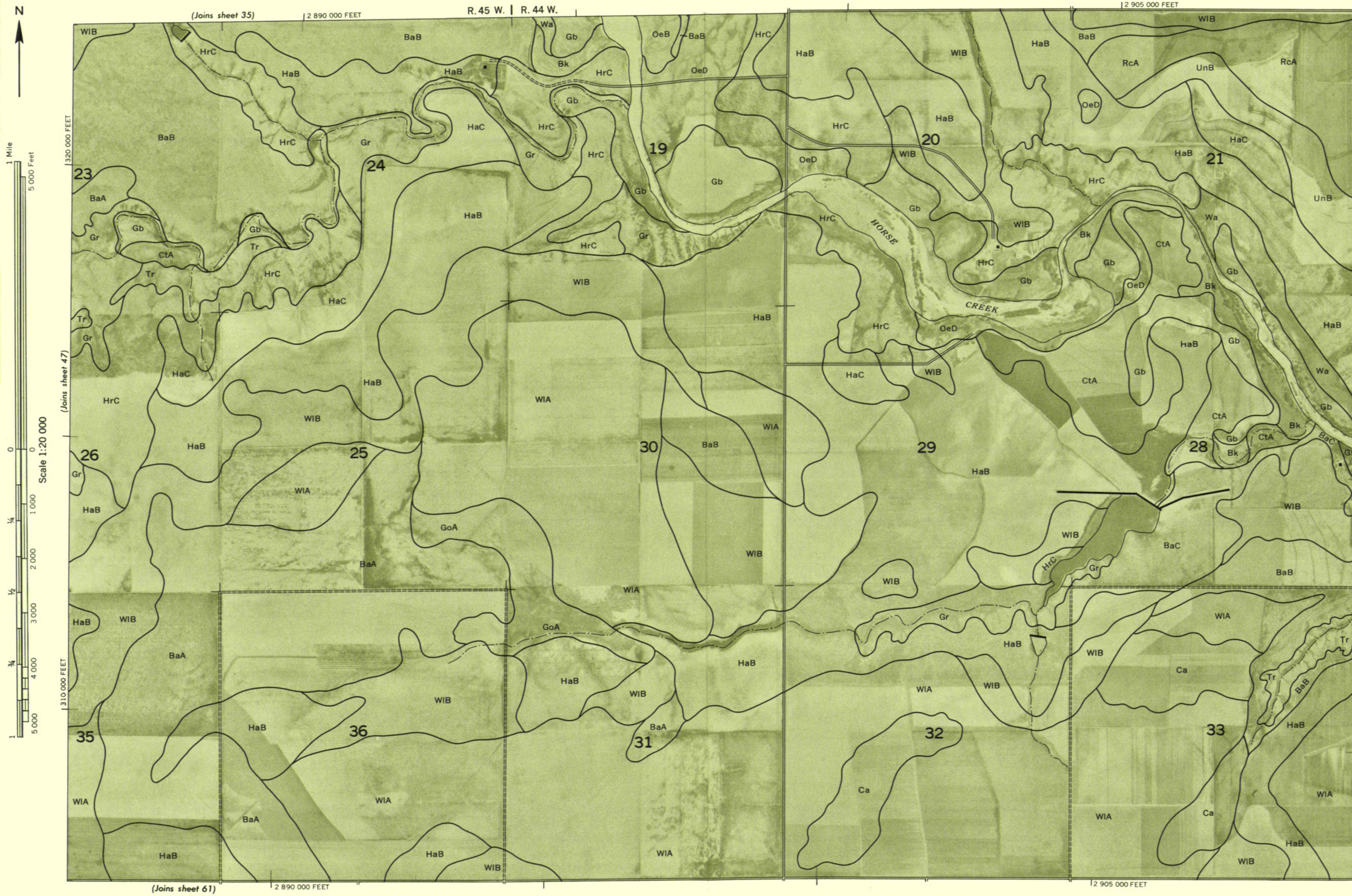
BACA COUNTY, COLORADO NO. 46



BACA COUNTY, COLORADO NO. 47

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 48



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 49

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone, 1927 North American Datum.

Land division corners are approximately positioned on this map.

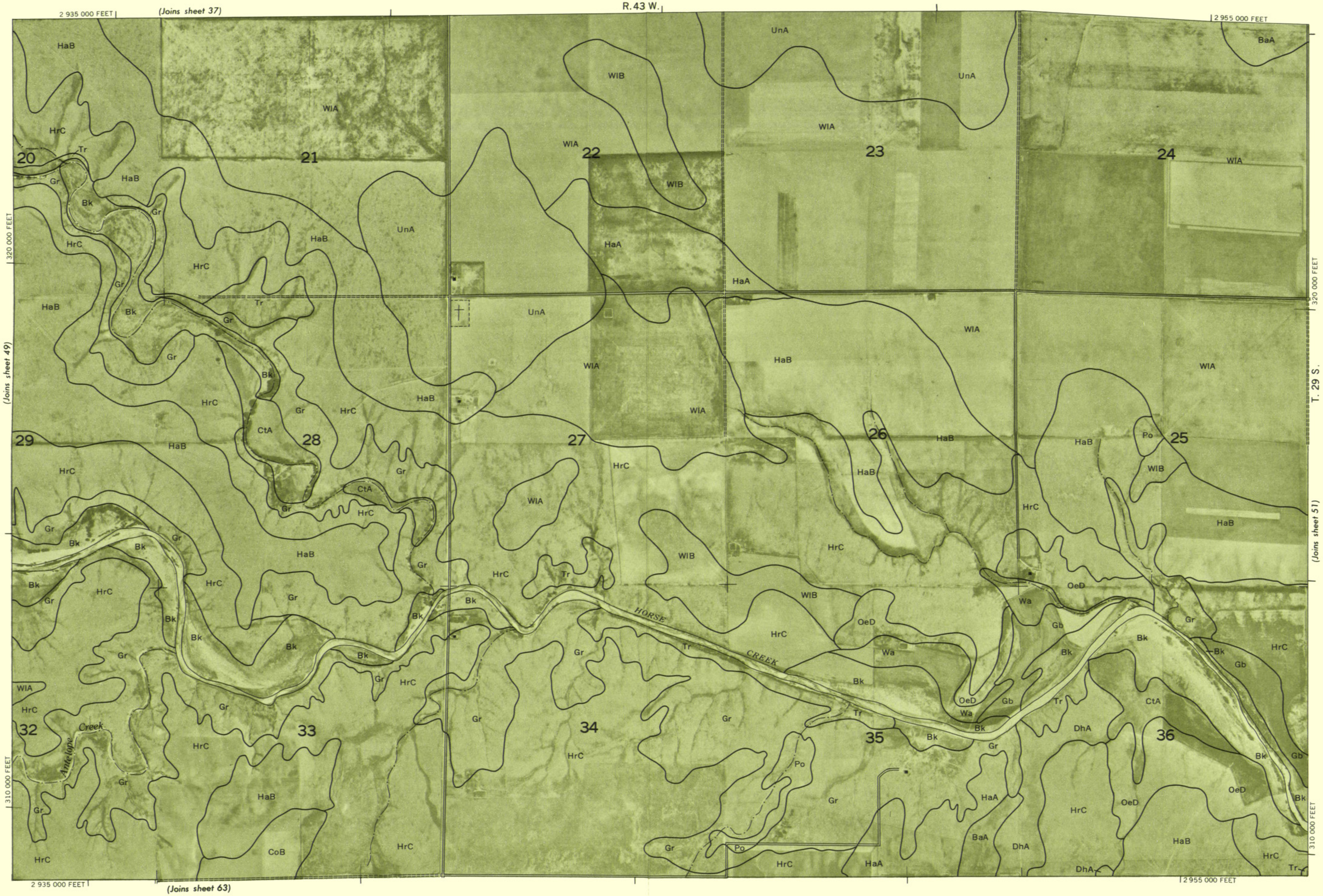
BACA COUNTY, COLORADO — SHEET NUMBER 50

N

Scale 1:20 000

1 Mile

5 000 Feet



Land division corners are approximately positioned on this map.

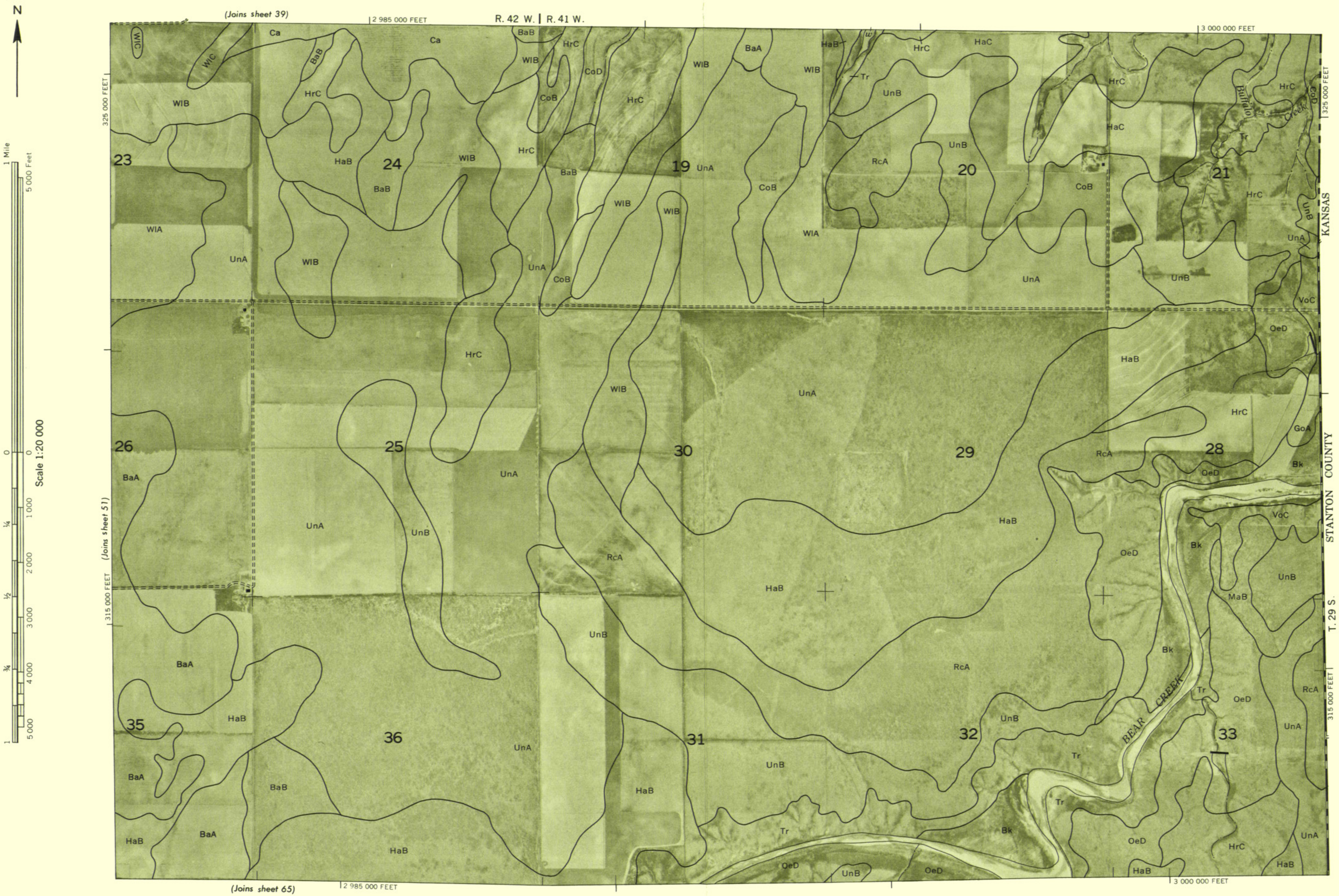
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 51

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 52



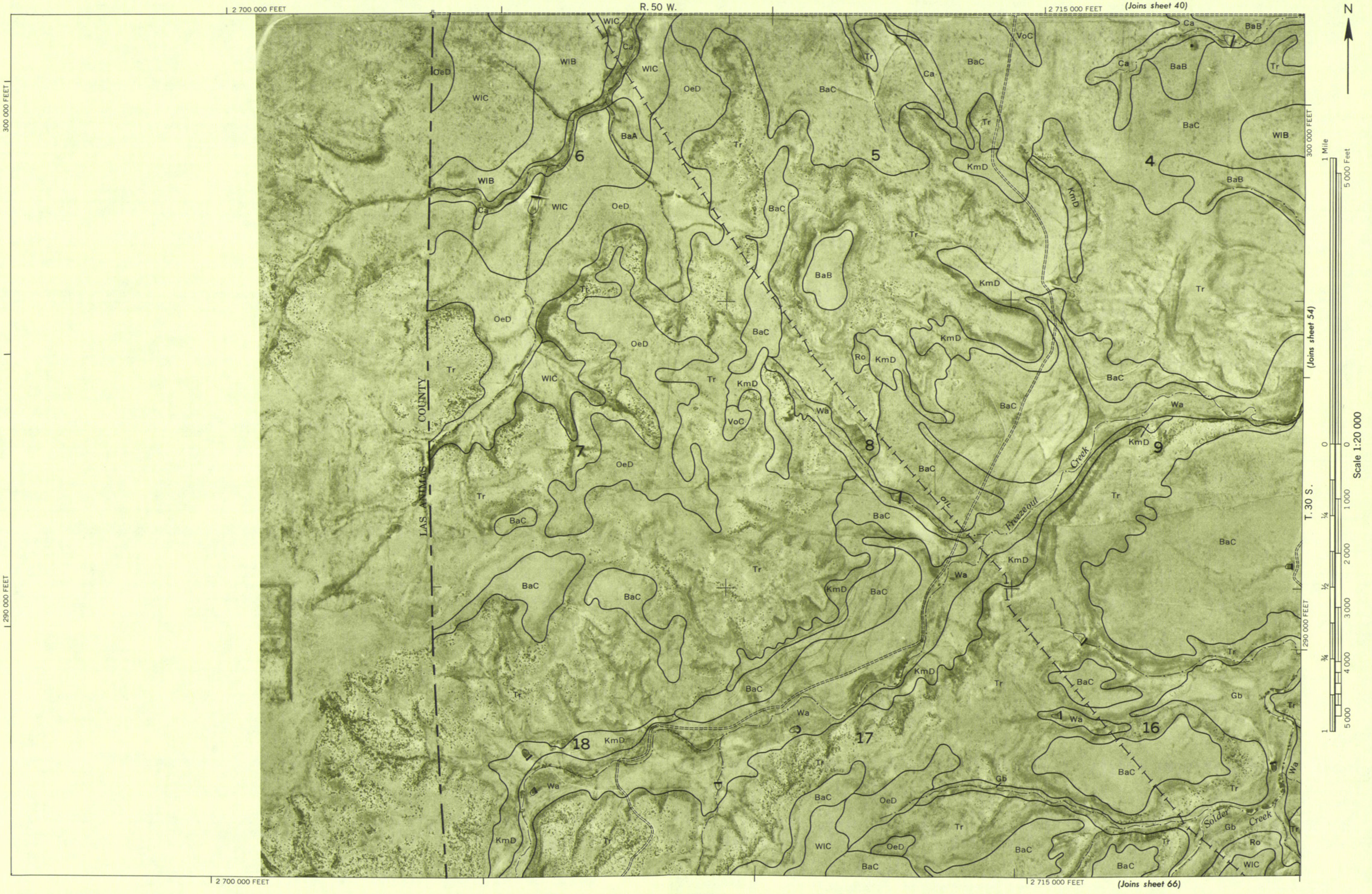
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 52

53

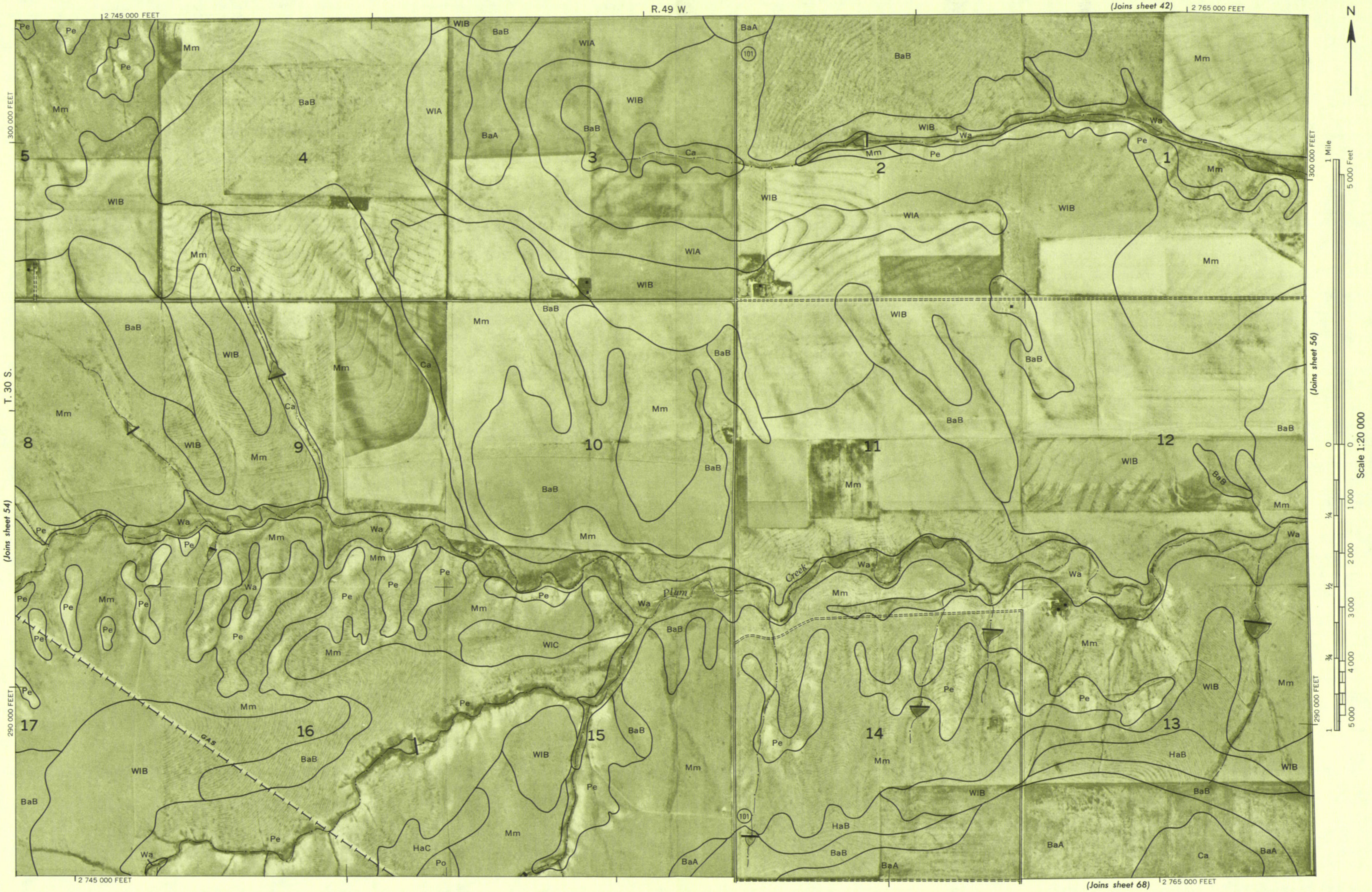


BACA COUNTY, COLORADO NO. 53

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 54

Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 55

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 56

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 56

BACA COUNTY, COLORADO NO. 57

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone, 1927 North American Datum.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

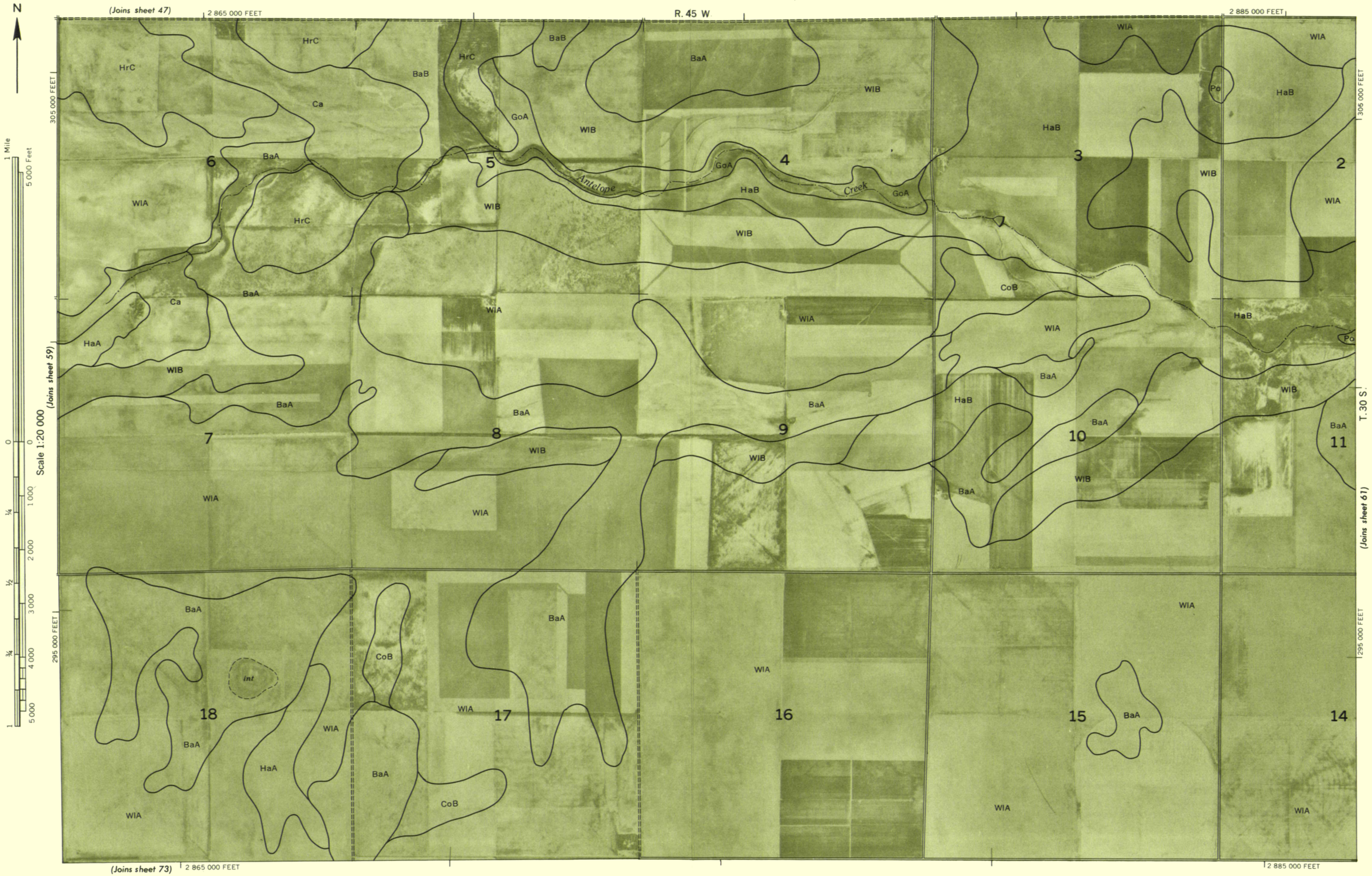
BACA COUNTY, COLORADO NO. 59

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

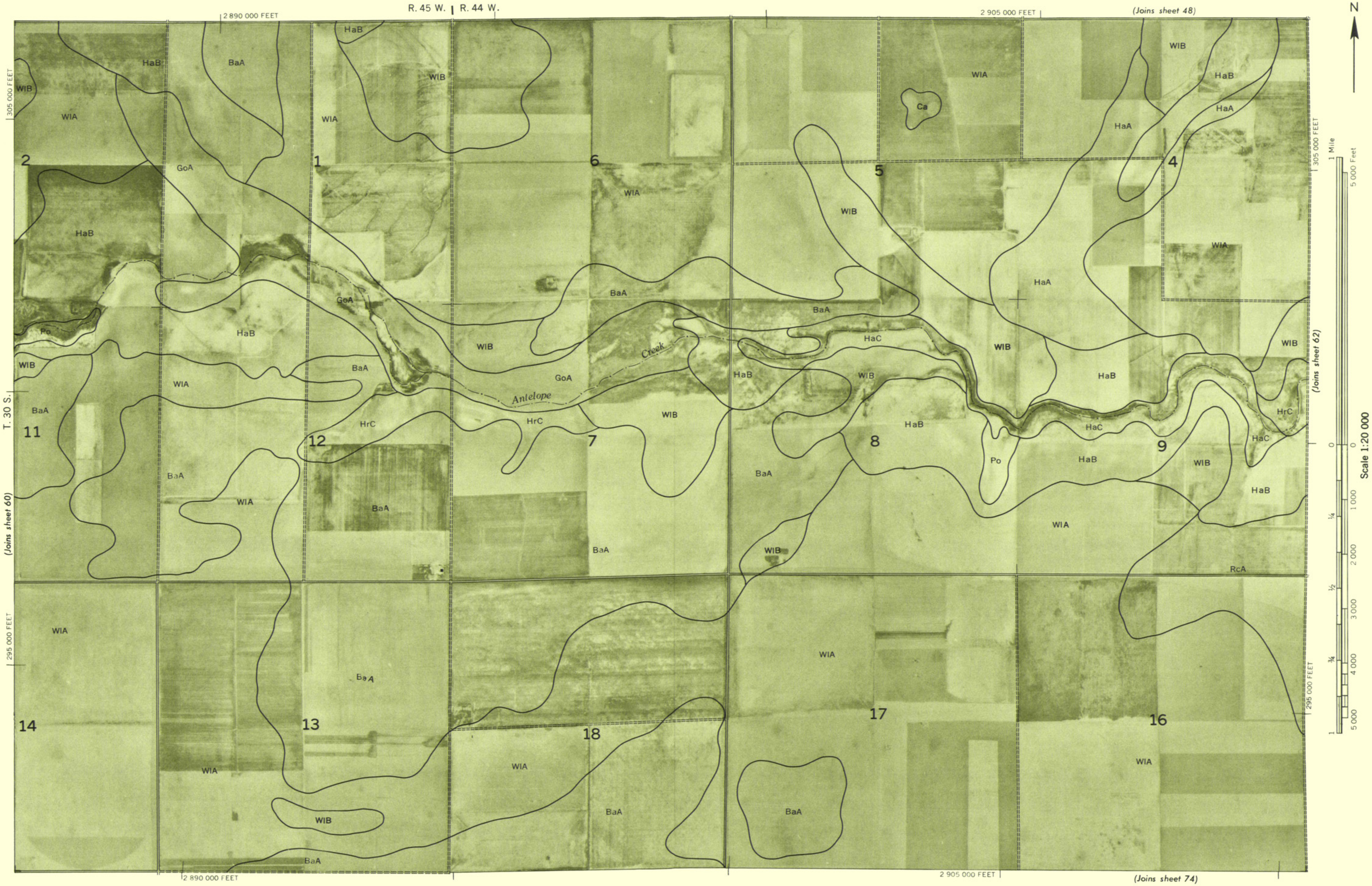
BACA COUNTY, COLORADO — SHEET NUMBER 60



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

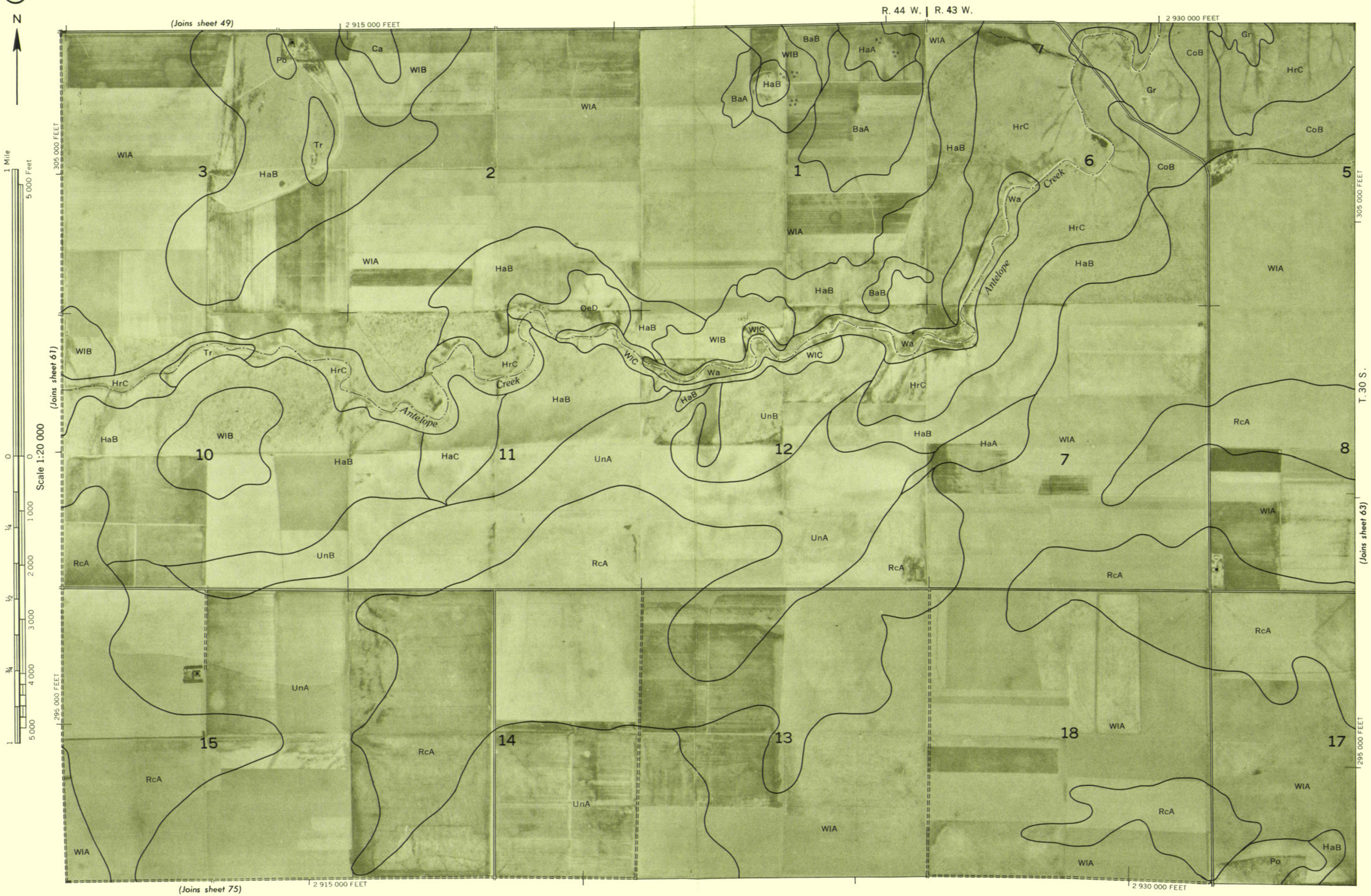
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 61

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 62



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 62

BACA COUNTY, COLORADO NO. 63

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 64

N

Scale 1:20 000

1 Mile ¾ ½ ¼ 0

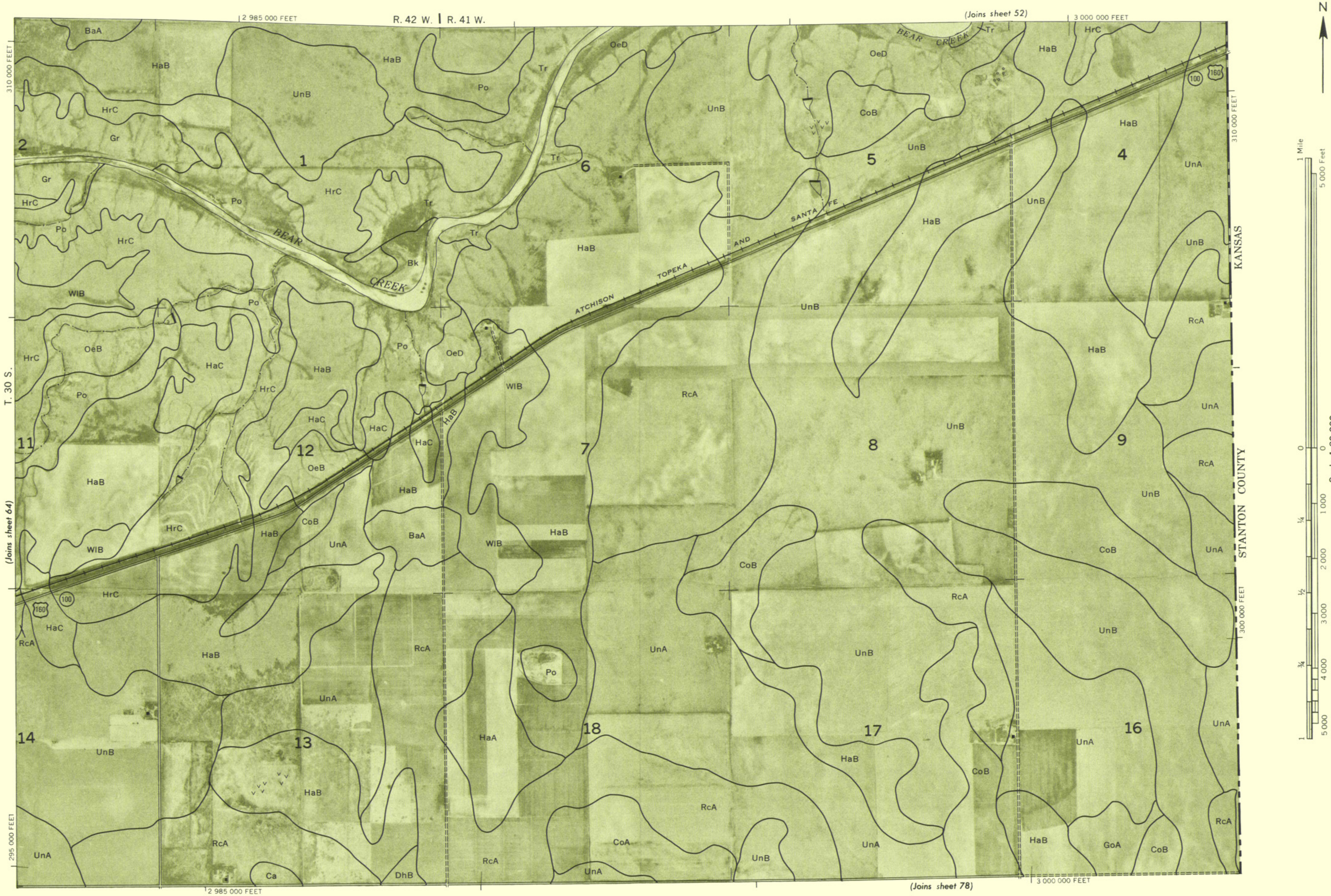
5 000 Feet 5000 4000 3000 2000 1000 0

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 64



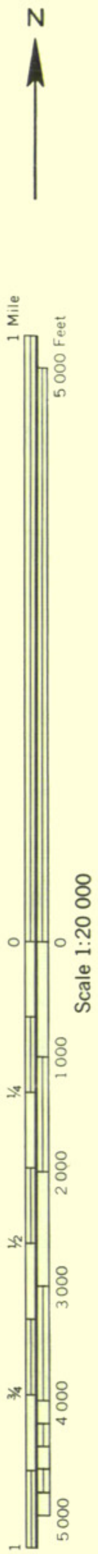
BACA COUNTY, COLORADO NO. 65

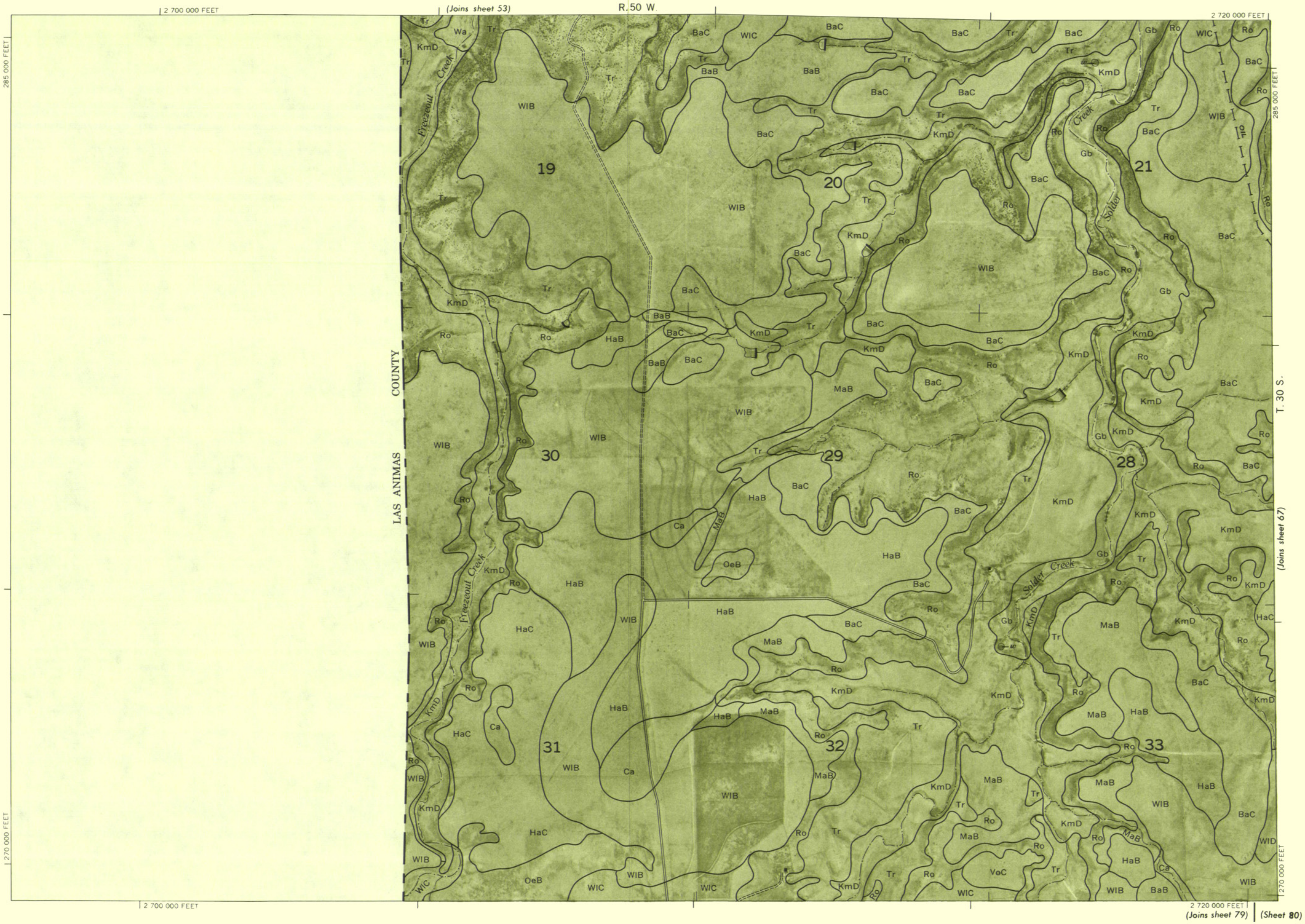
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 66

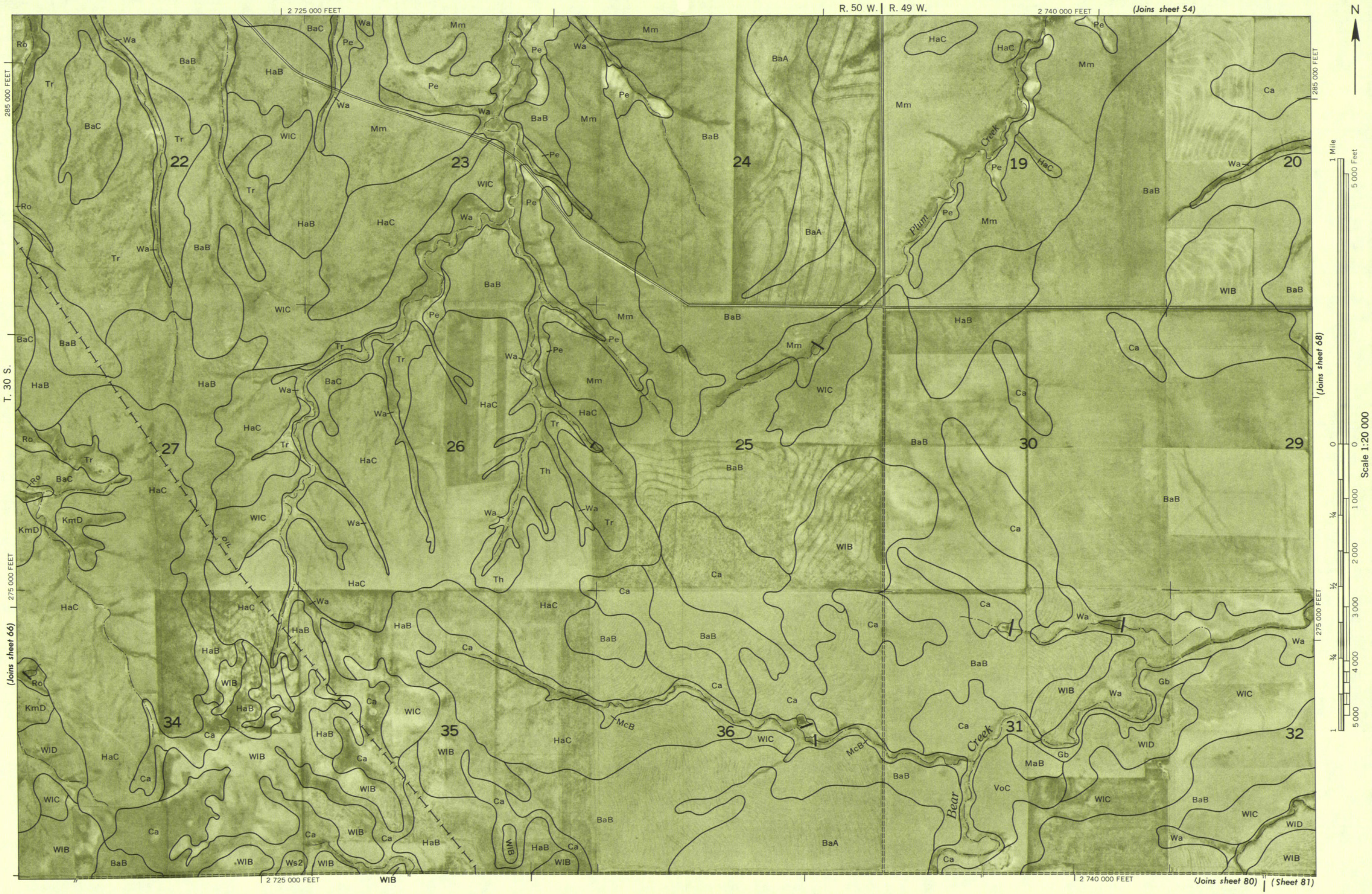




Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 67

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

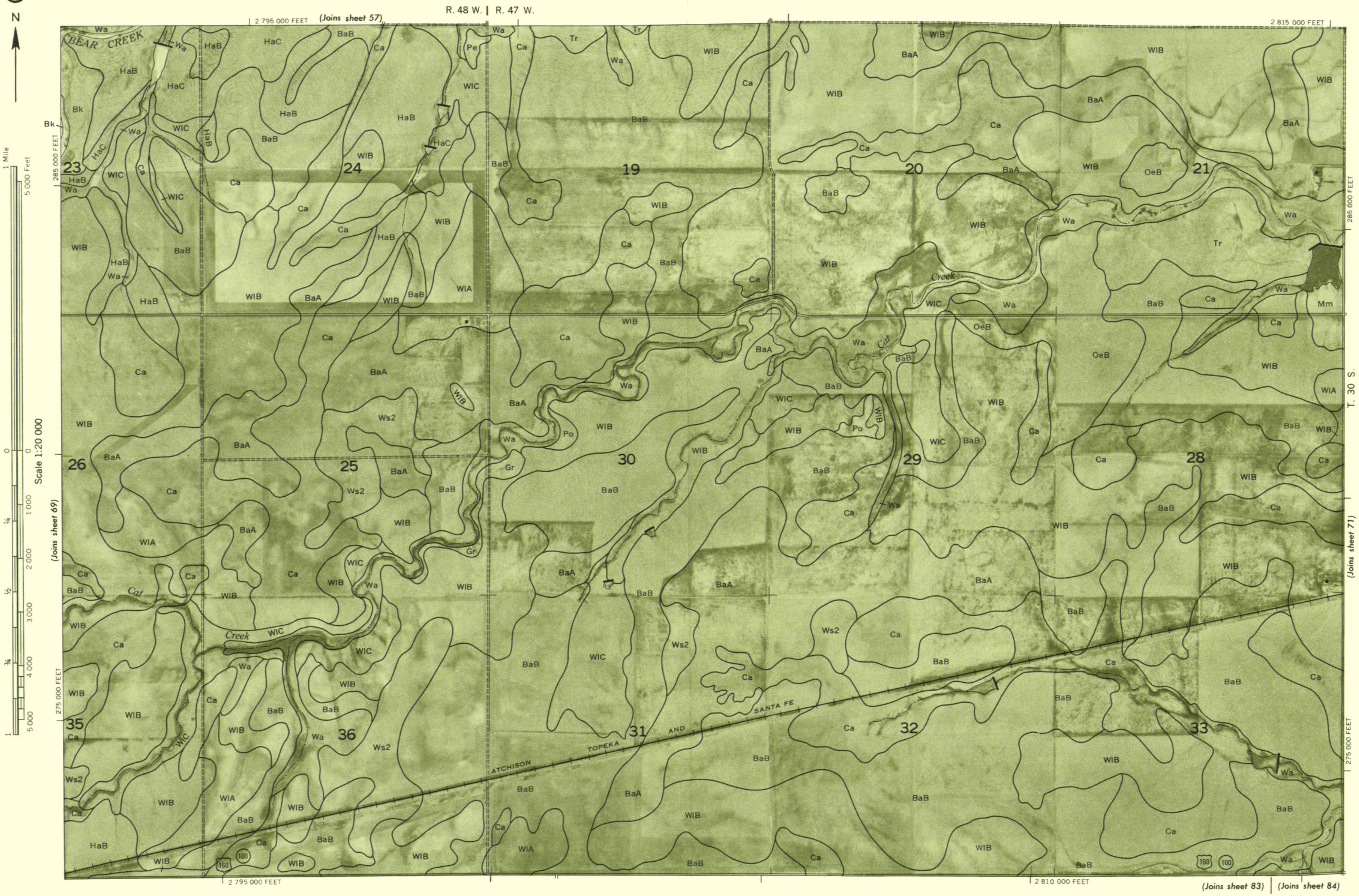
BACA COUNTY, COLORADO NO. 69

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 70



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

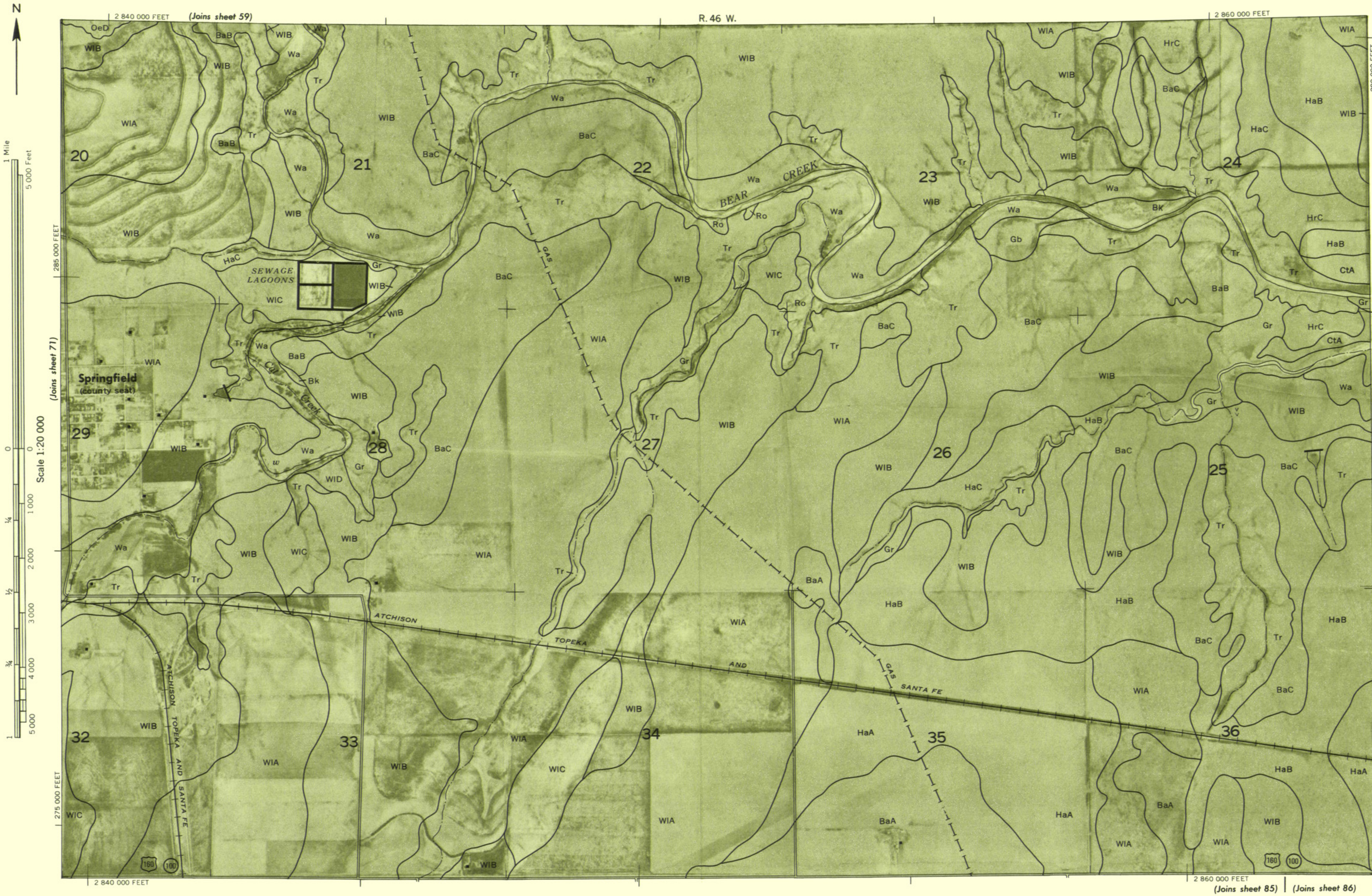
BACA COUNTY, COLORADO NO. 71

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

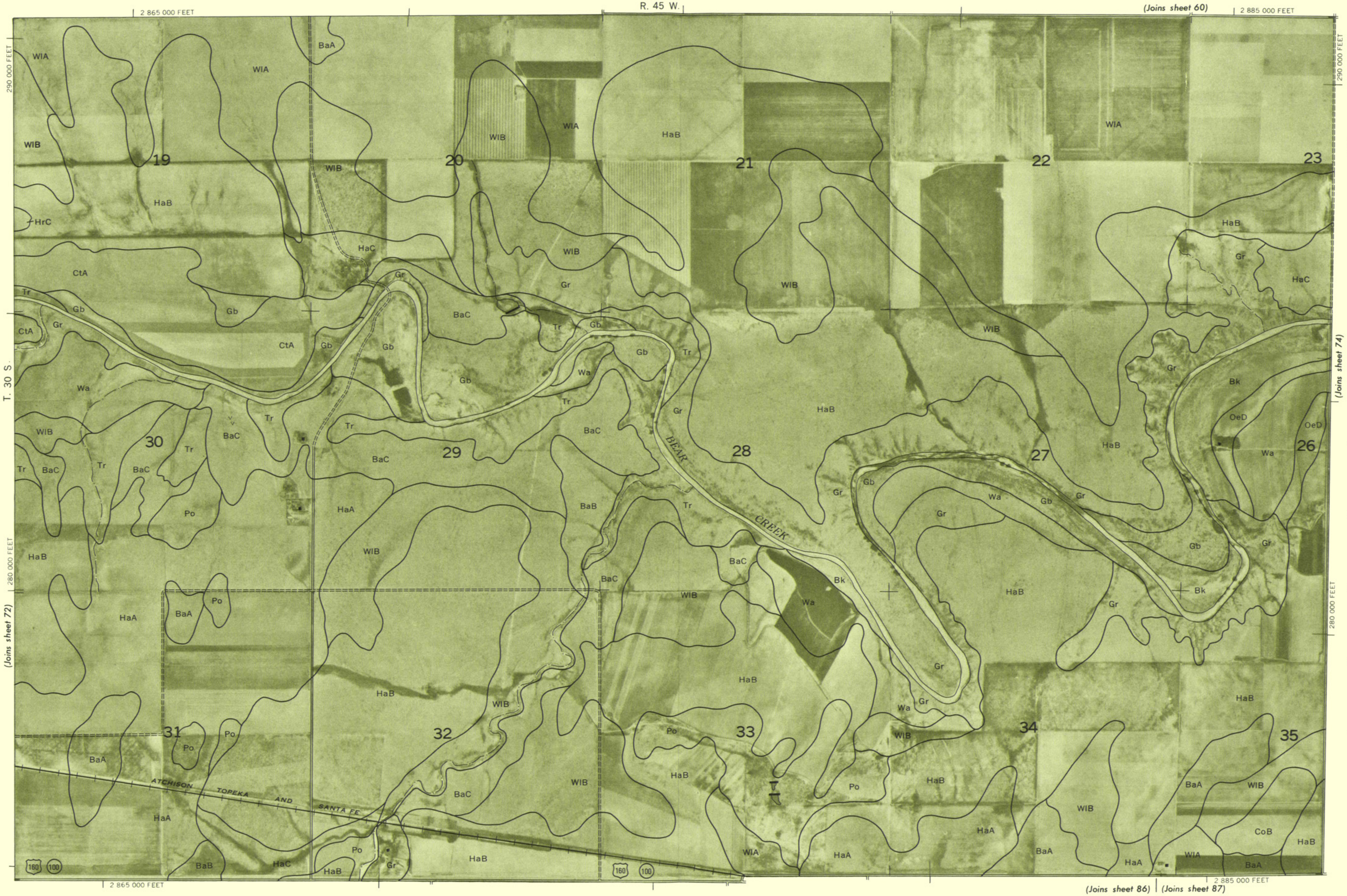
BACA COUNTY, COLORADO — SHEET NUMBER 72



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



N

Scale 1:20 000

1 Mile

5 000 Feet

BACA COUNTY, COLORADO NO. 73

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 74

N

1 Mile
5 000 Feet
0
0
¼
1 000
2 000
½
3 000
¾
4 000
5 000
1
Scale 1:20 000

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone, 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

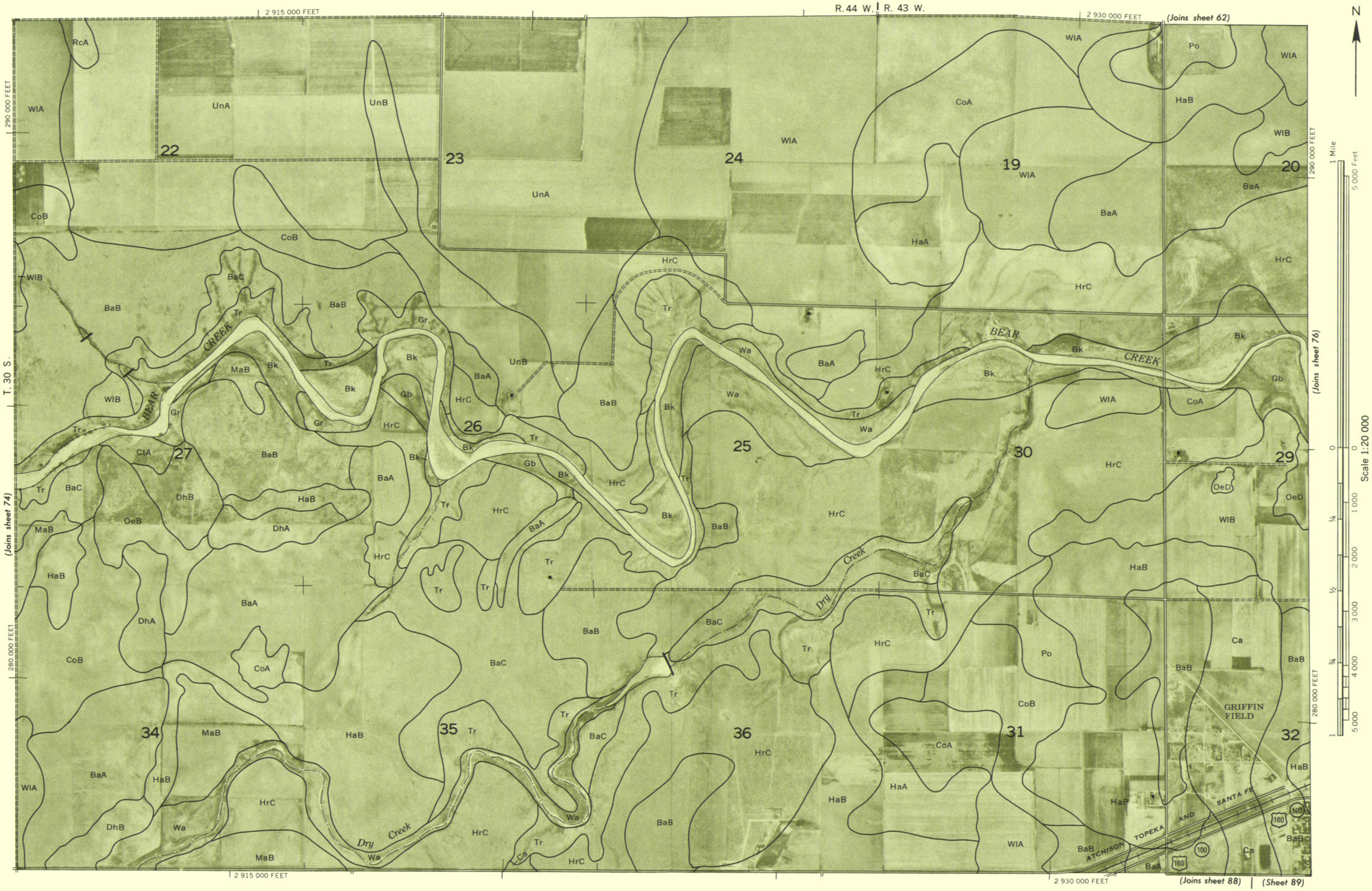
BACA COUNTY, COLORADO NO. 74

BACA COUNTY, COLORADO NO. 75

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.



BACA COUNTY, COLORADO — SHEET NUMBER 76

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 76

BACA COUNTY, COLORADO NO. 77

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 78

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 79

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

N

BACA COUNTY, COLORADO — SHEET NUMBER 80

(Sheet 66) | (Joins sheet 67)

R. 50 W. | R. 49 W.

2 725 000 FEET

2 740 000 FEET

(Joins sheet 79)

(Joins sheet 81)

(Joins sheet 93)

T. 31 S

265 000 FEET

255 000 FEET

Scale 1:20 000

1 Mile

5 000 Feet

Land division corners are approximately positioned on this map

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station

(Sheet 67) | (Joins sheet 68)

BACA COUNTY, COLORADO NO. 81

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

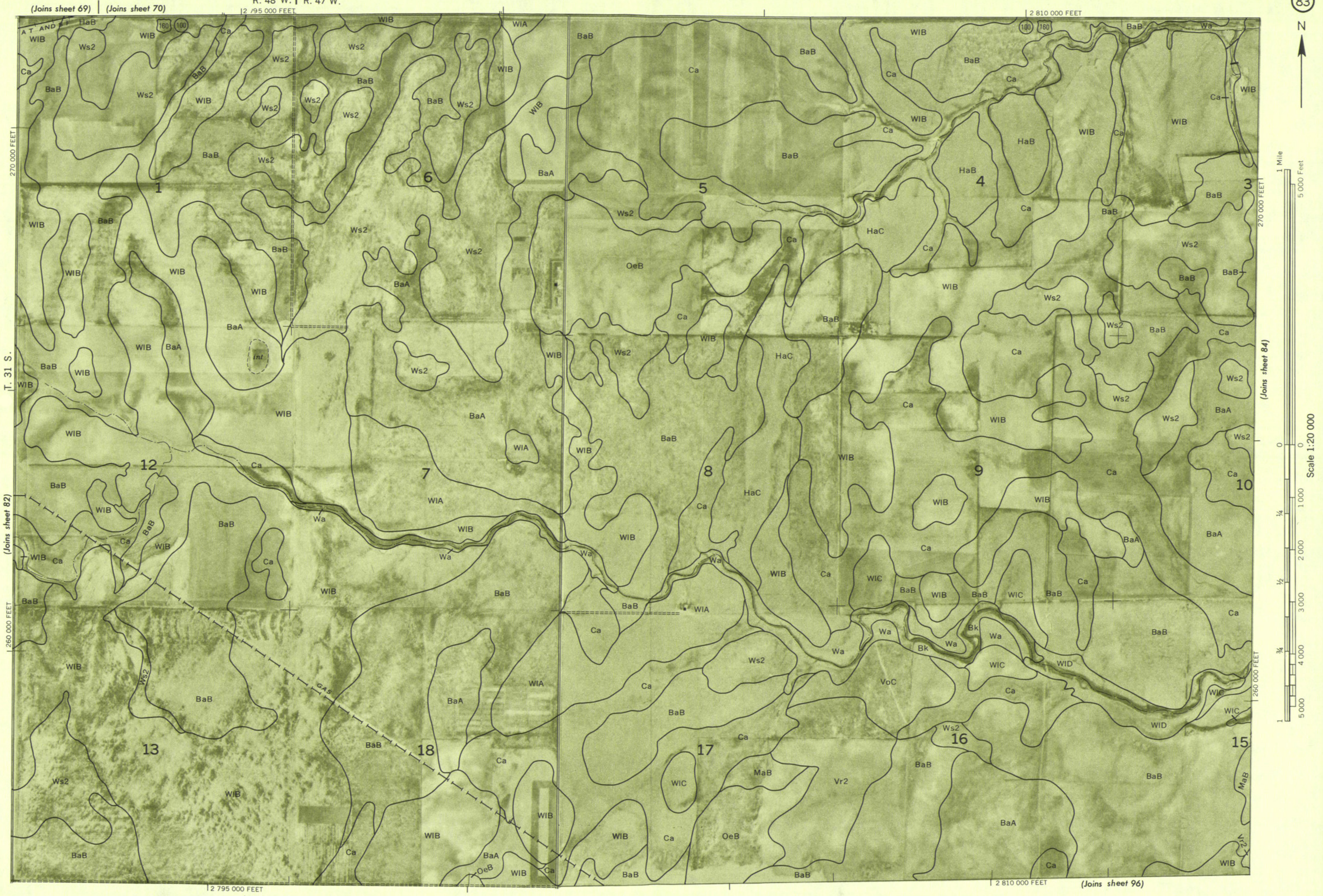
BACA COUNTY, COLORADO NO. 82

BACA COUNTY, COLORADO NO. 83

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

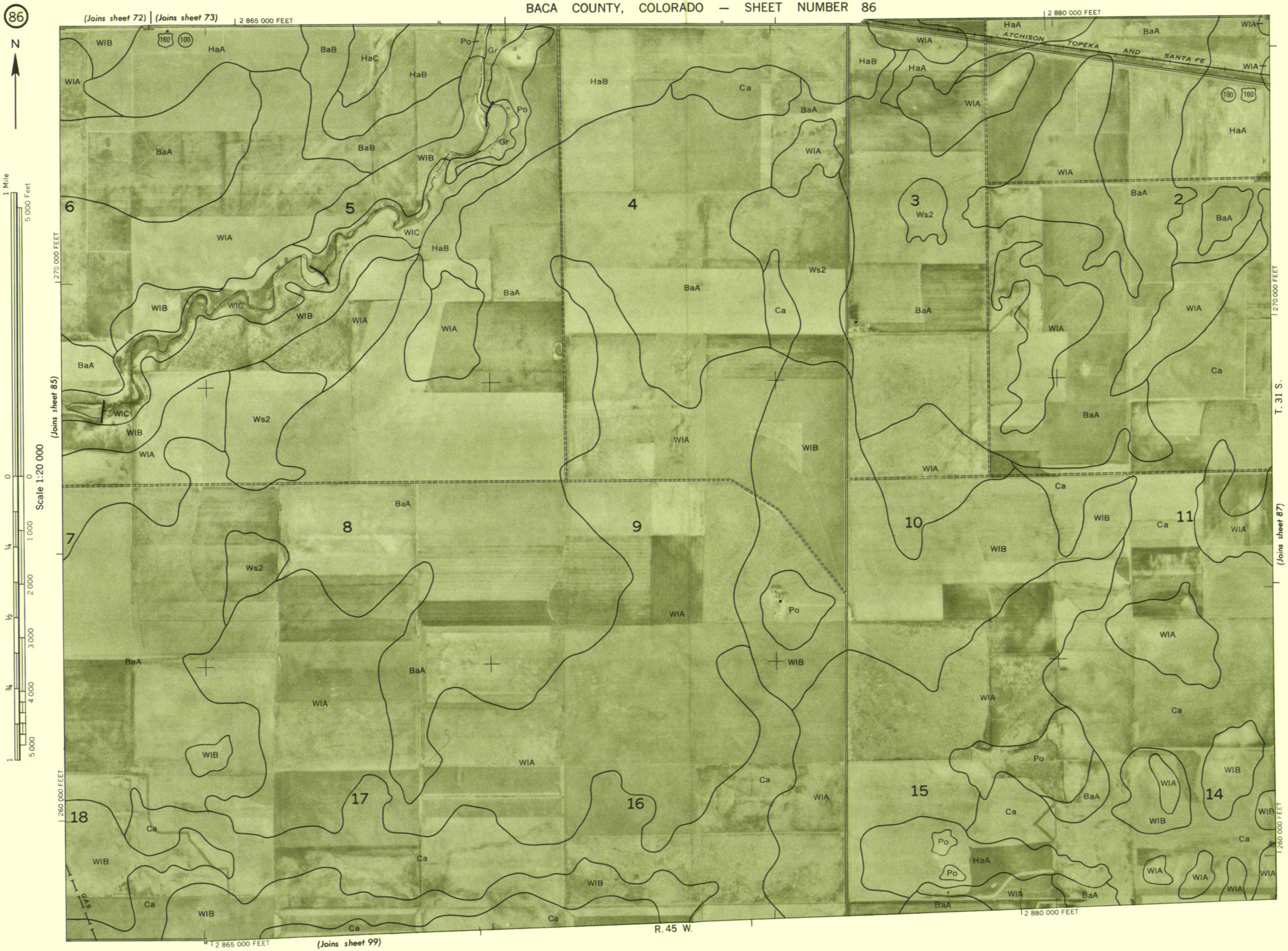


Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 85

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 86



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

(Joins sheet 73) (Joins sheet 74) R. 45 W. | R. 44 W.

(Joins sheet 100)

N

1 Mile

5000 Feet

Scale 1:20 000

0 ¼ ½ ¾ 1

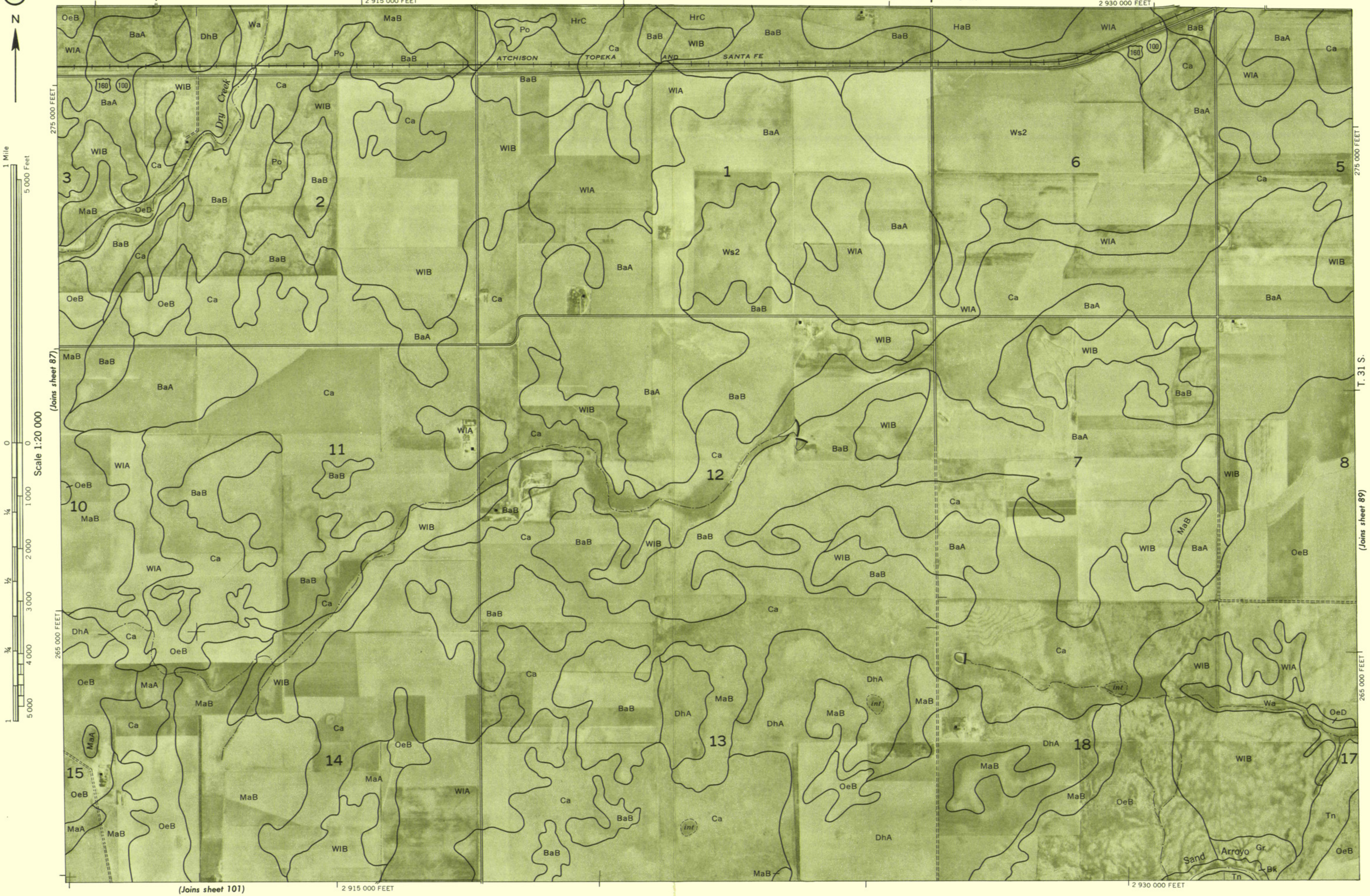
0 1000 2000 3000 4000 5000

BACA COUNTY, COLORADO NO. 87

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station. Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum. Land division corners are approximately positioned on this map.

88

BACA COUNTY, COLORADO — SHEET NUMBER 88



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 88

BACA COUNTY, COLORADO — SHEET NUMBER 89

89

BACA COUNTY, COLORADO NO. 89

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

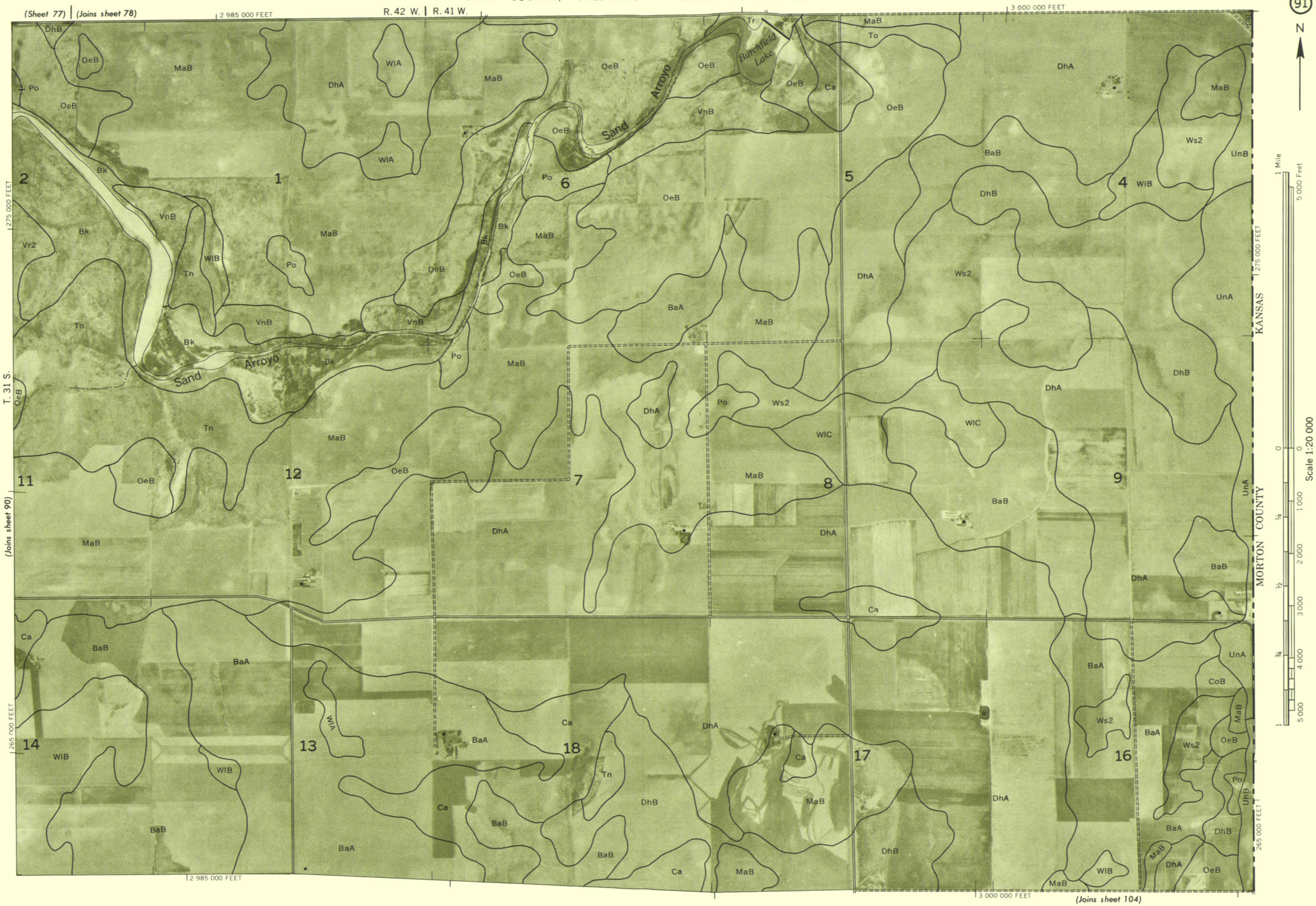
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 90

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



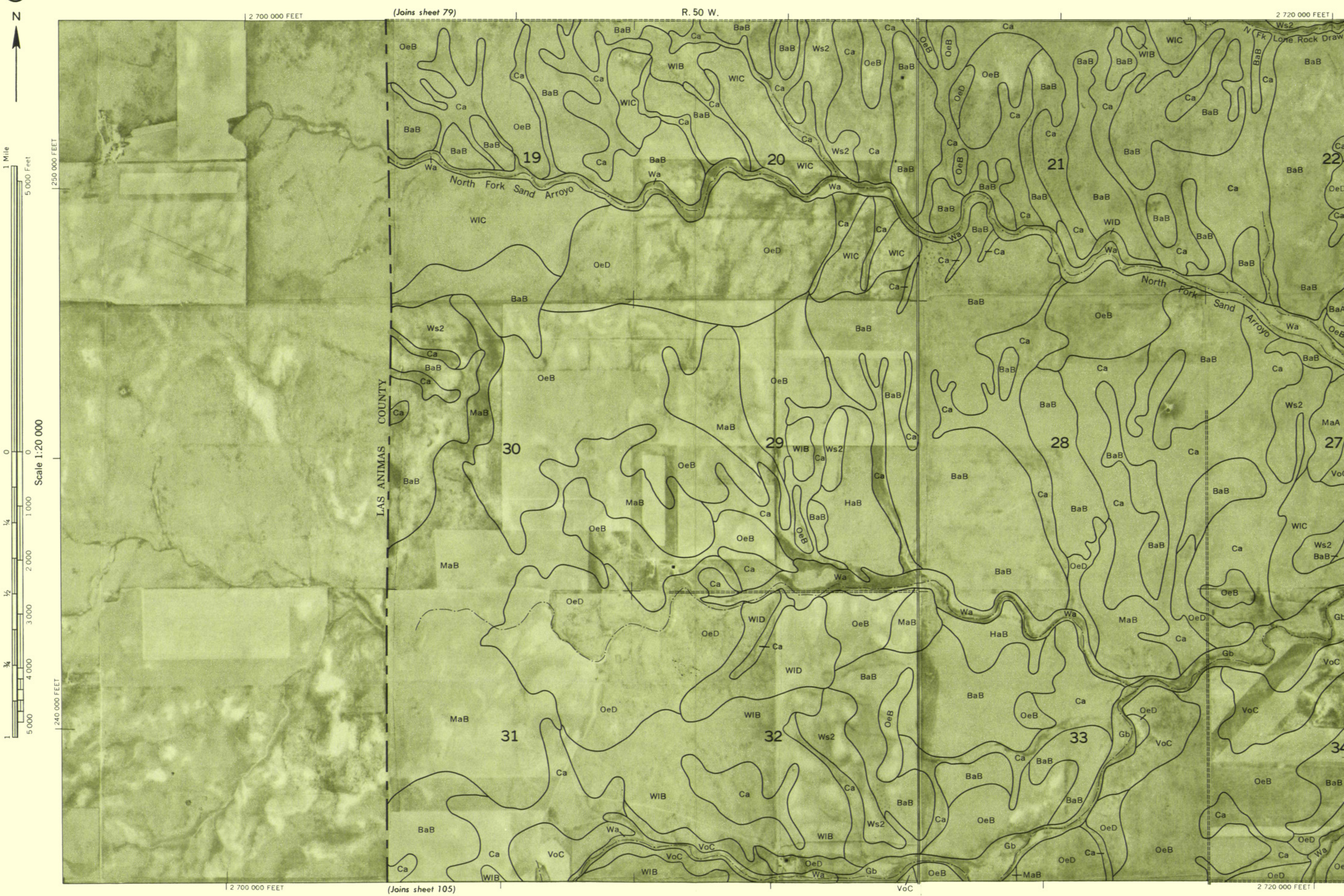
BACA COUNTY, COLORADO NO. 91

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

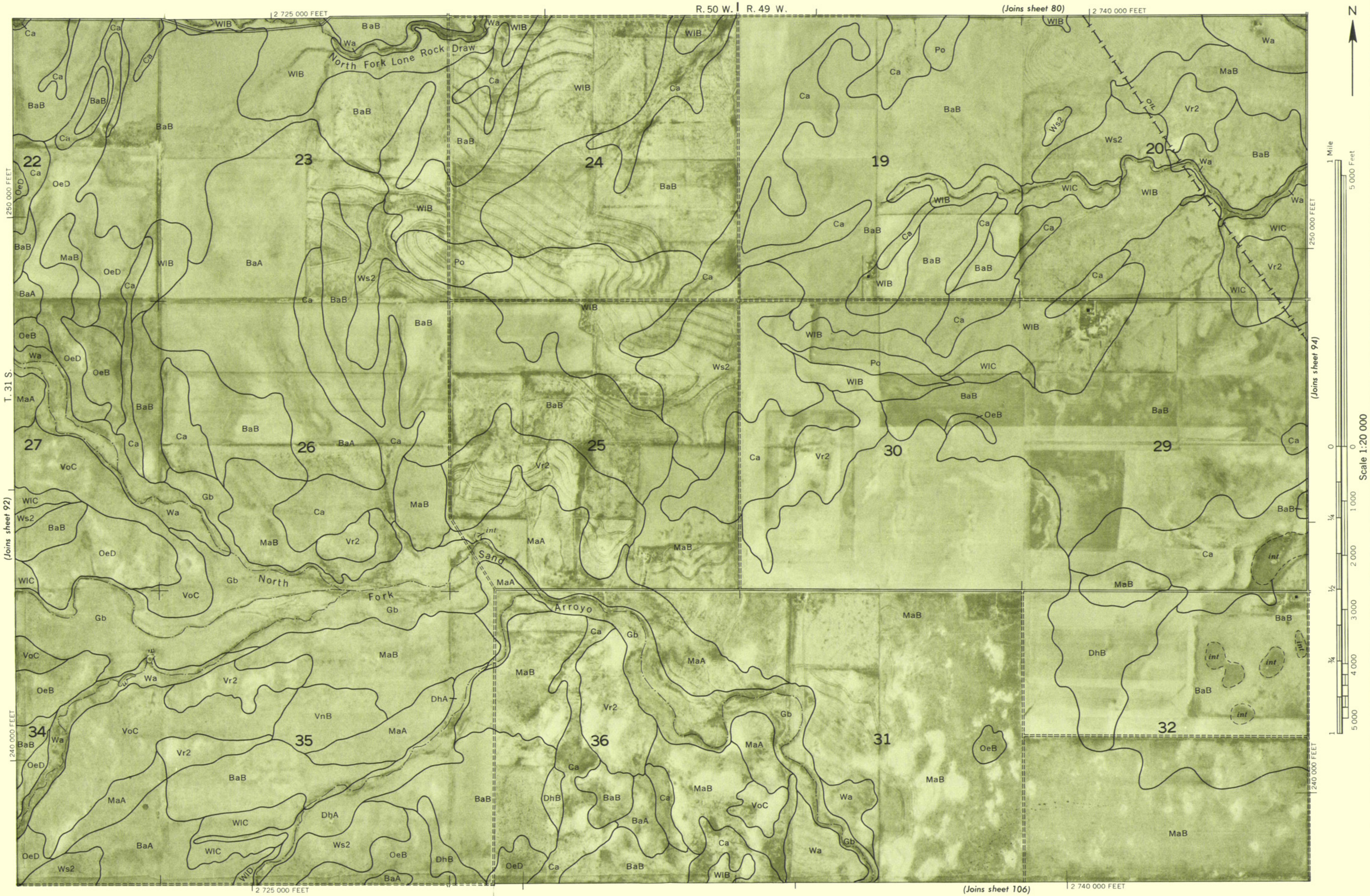
BACA COUNTY, COLORADO — SHEET NUMBER 92



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 94

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 95

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

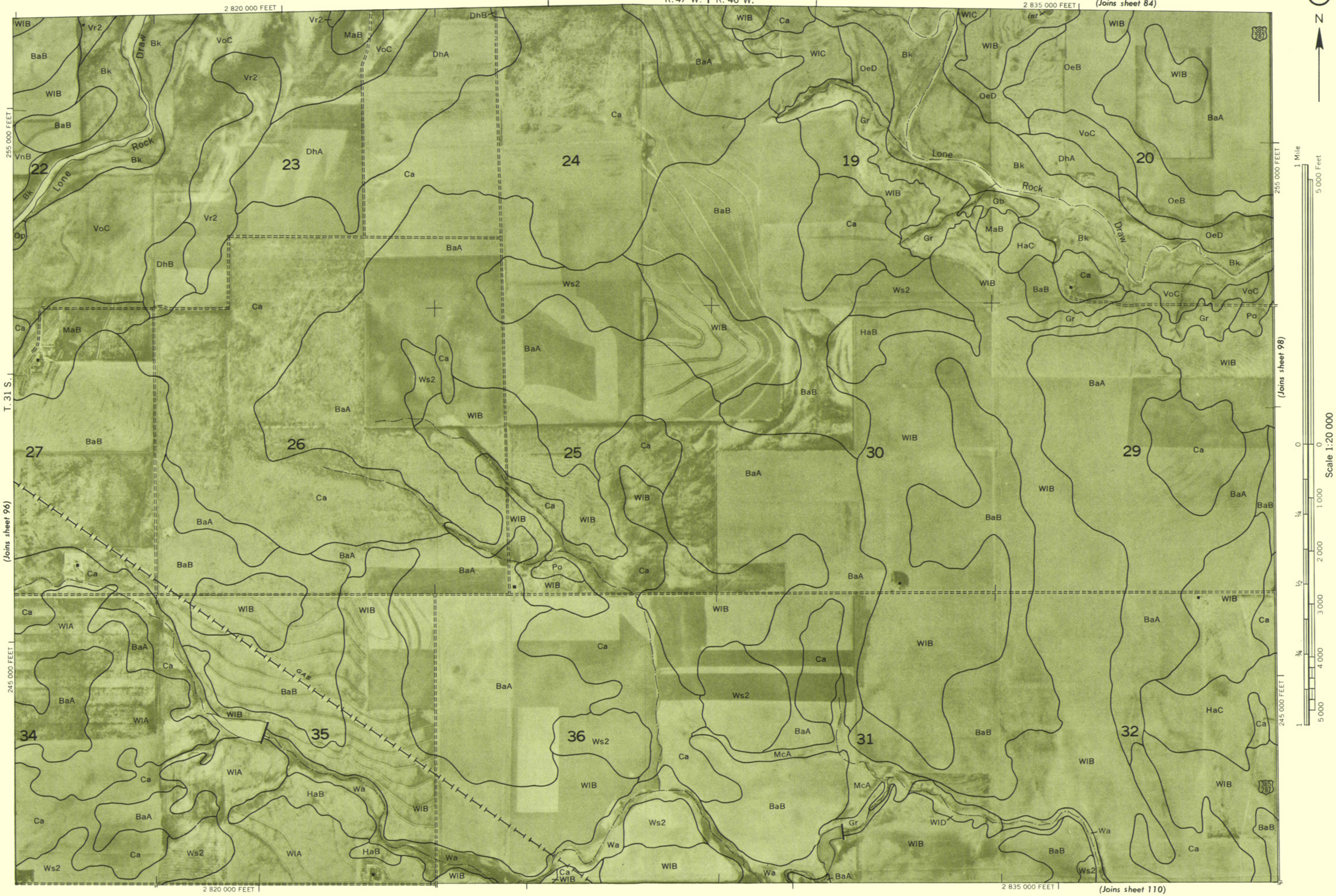
BACA COUNTY, COLORADO — SHEET NUMBER 96

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone 1927 North American Datum.

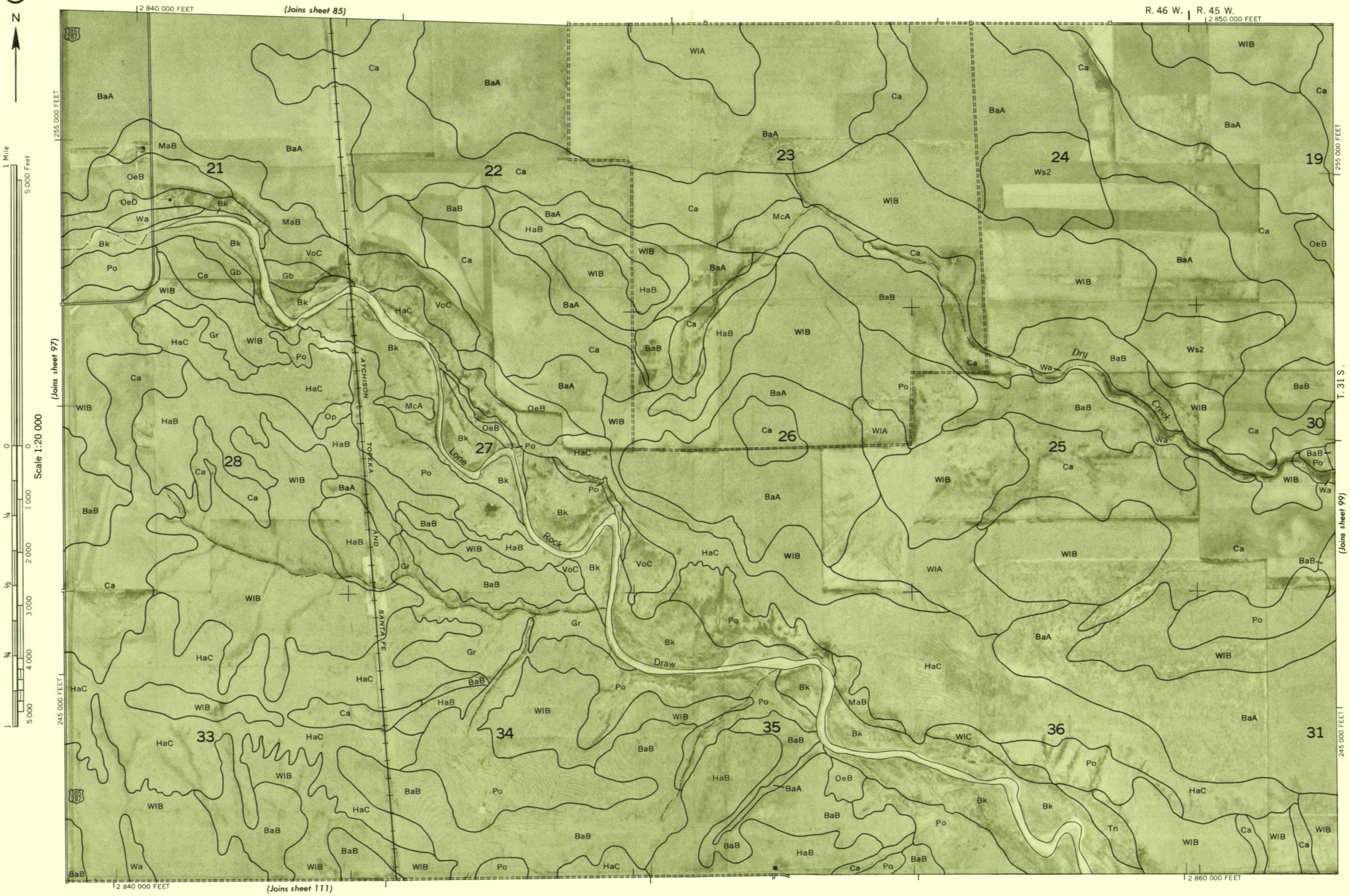
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 96



BACA COUNTY, COLORADO NO. 97

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

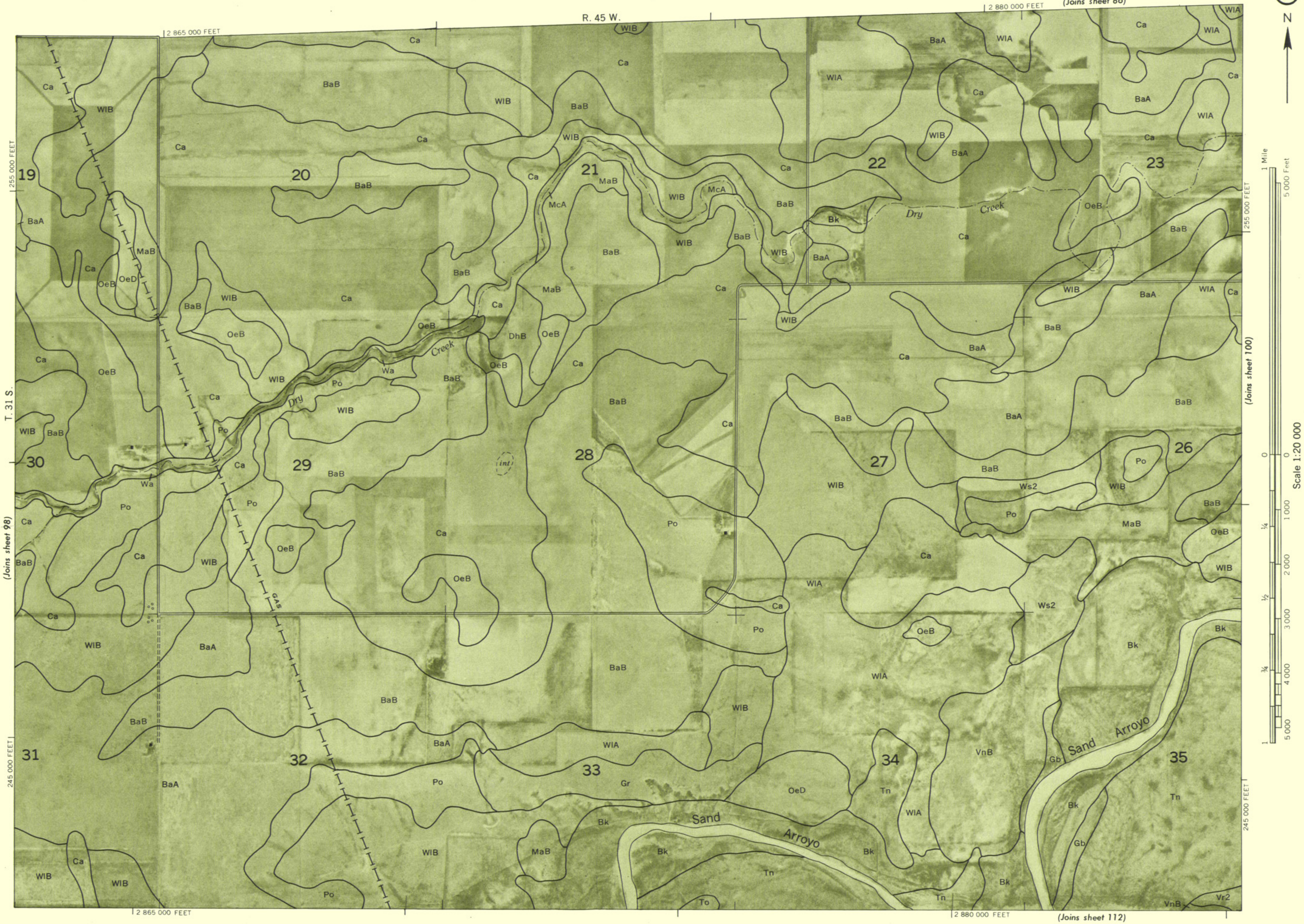
BACA COUNTY, COLORADO — SHEET NUMBER 99

BACA COUNTY, COLORADO NO. 99

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

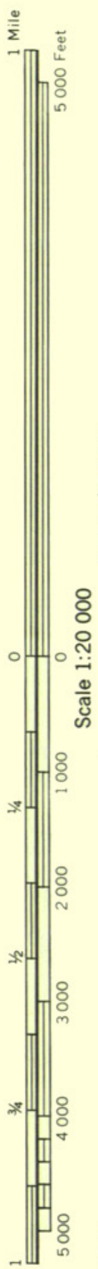
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.



BACA COUNTY, COLORADO — SHEET NUMBER 100

N



Scale 1:20 000

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States, Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 101

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone, 1927 North American Datum.
Land division corners are approximately positioned on this map.

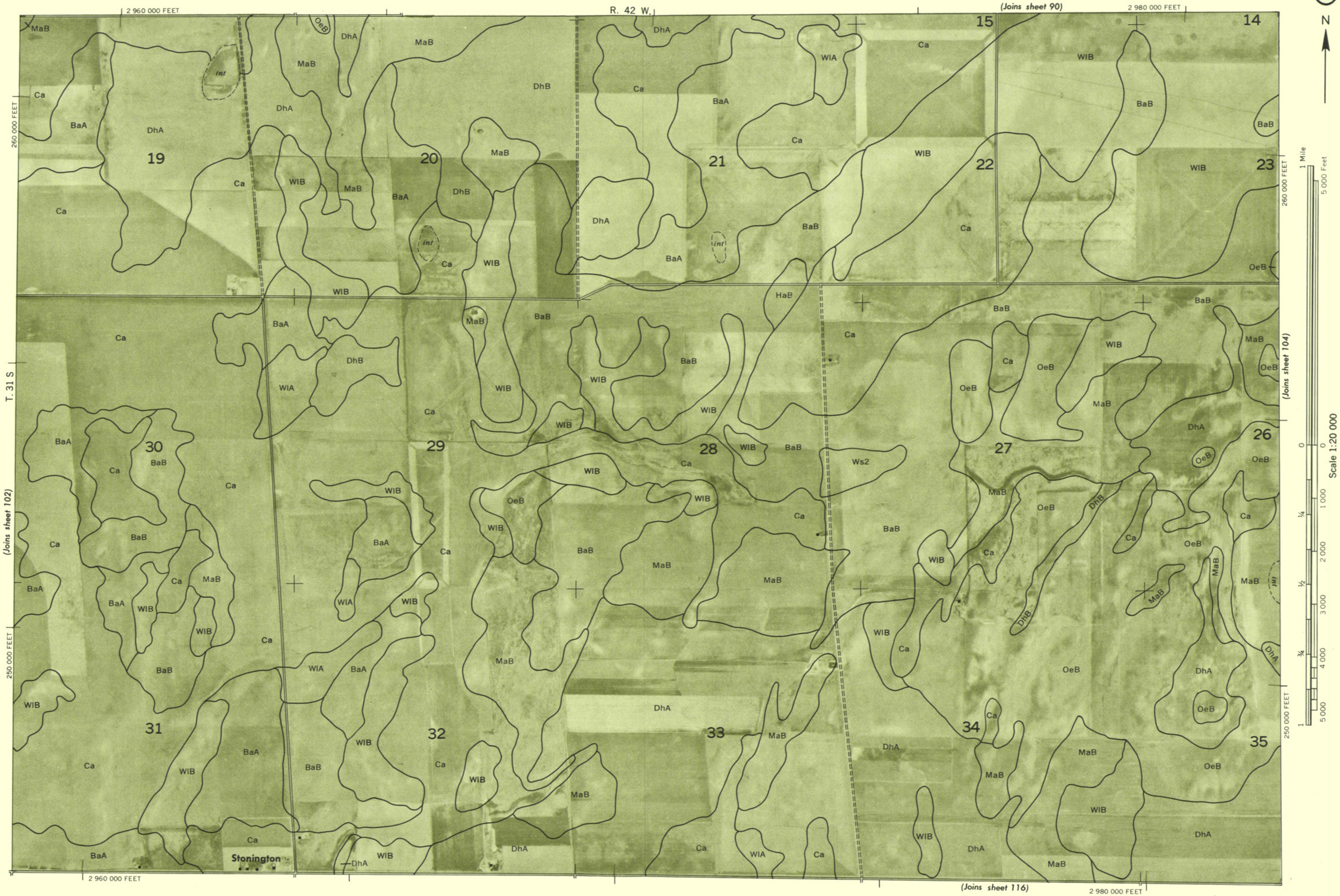
BACA COUNTY, COLORADO — SHEET NUMBER 102

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

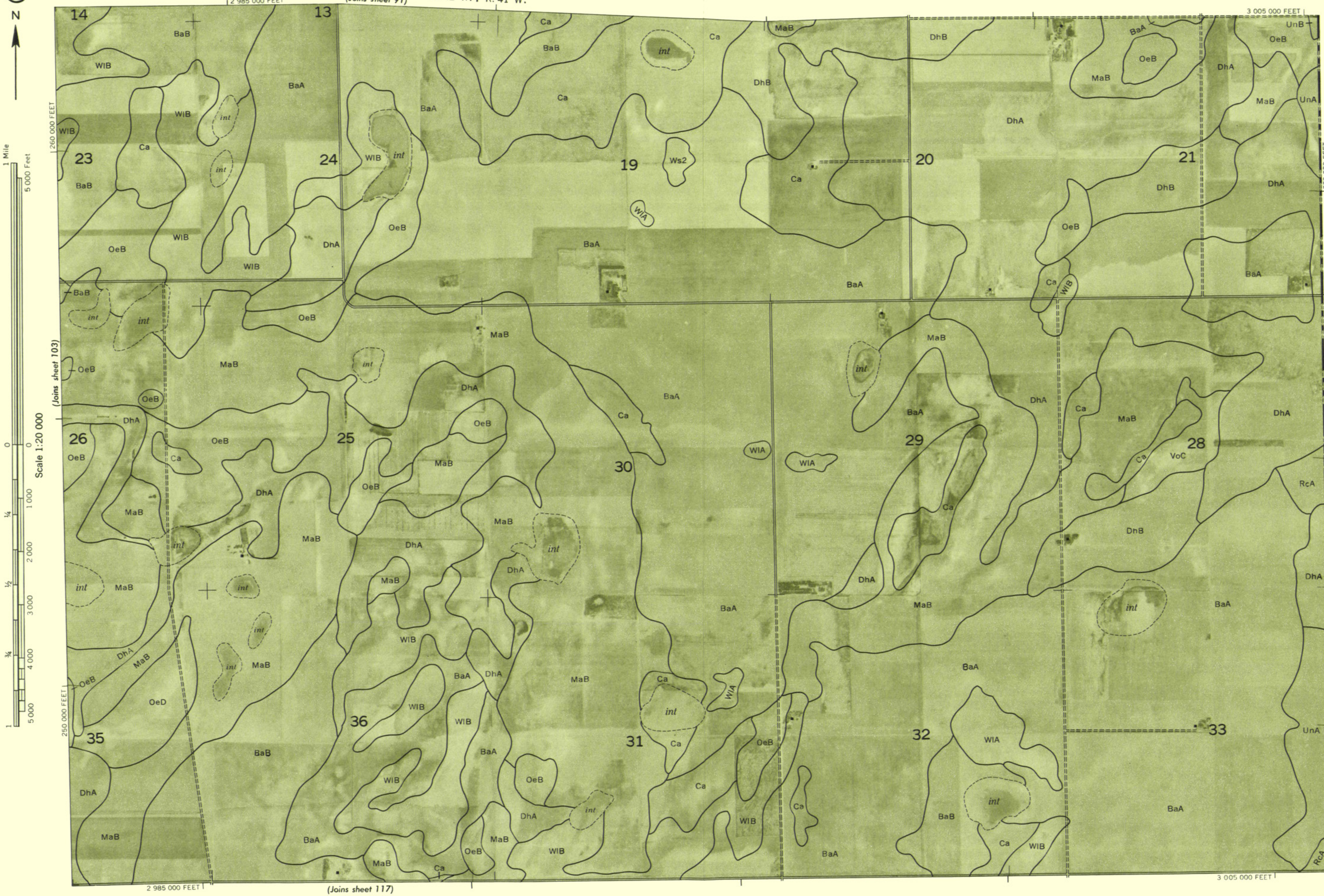
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

103



BACA COUNTY, COLORADO NO. 103

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, and the Colorado Agricultural Experiment Station.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

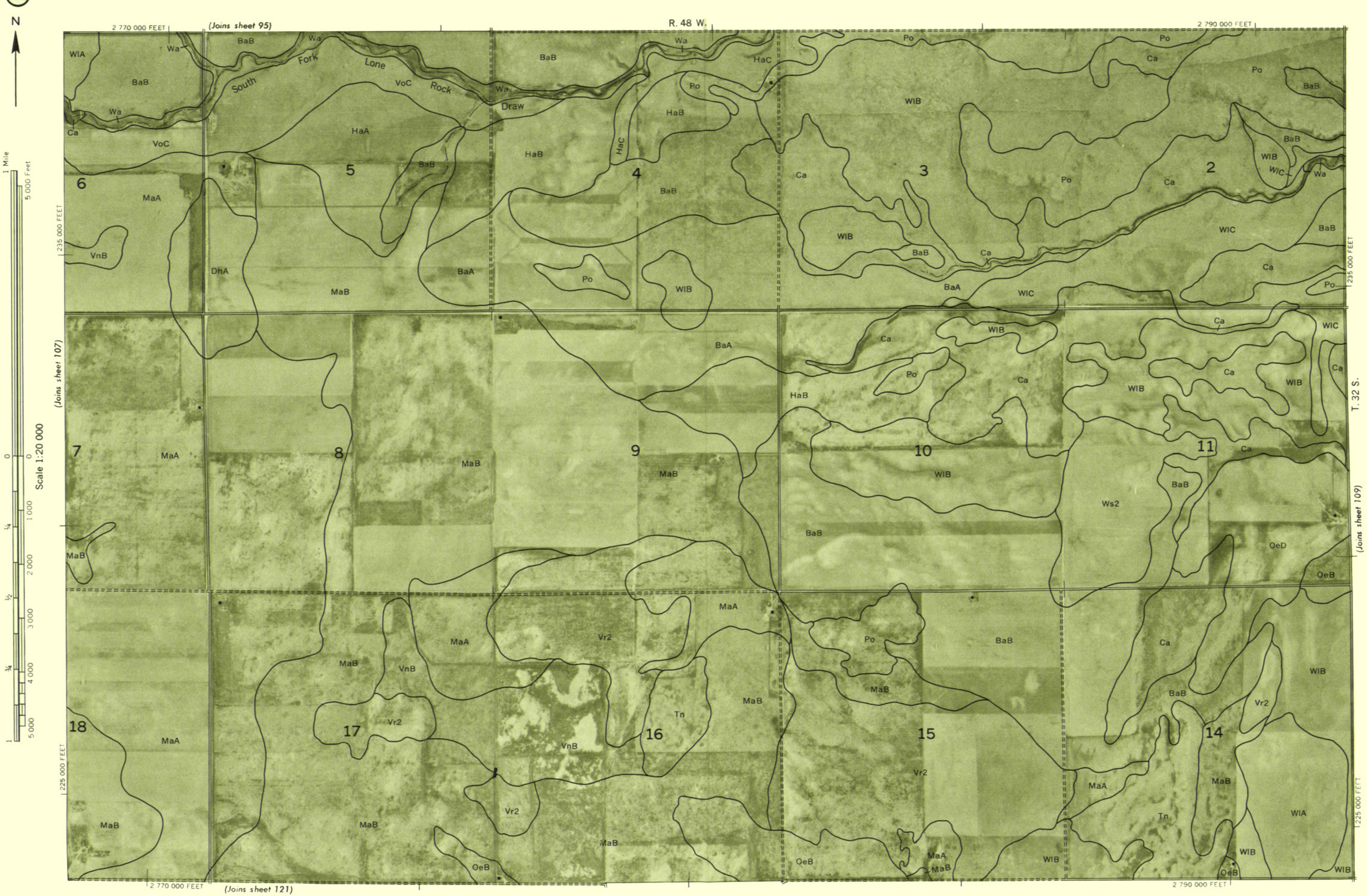
BACA COUNTY, COLORADO — SHEET NUMBER 106

Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, CLORADO NO. 106

BACA COUNTY, COLORADO NO. 107

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



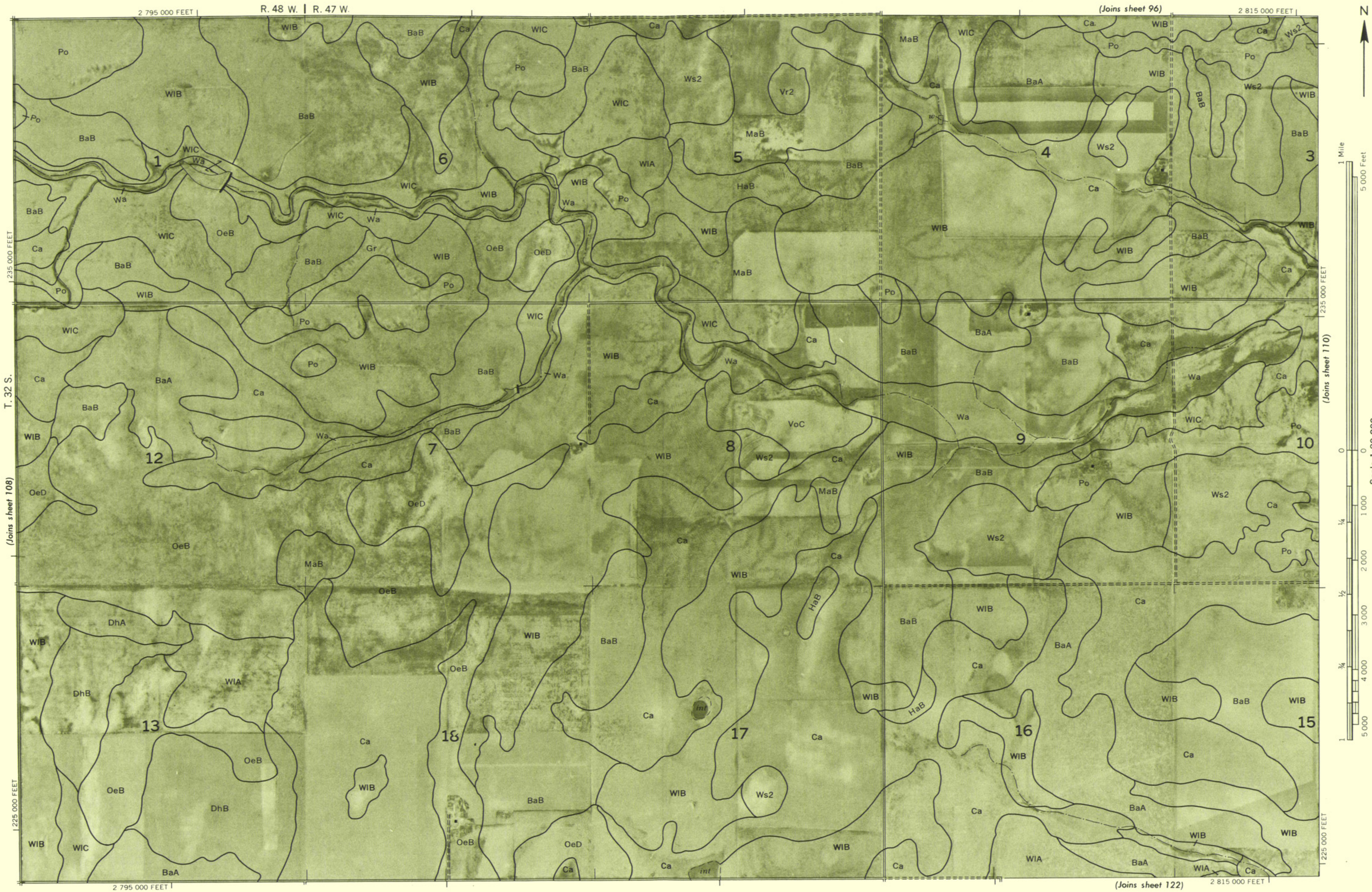
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

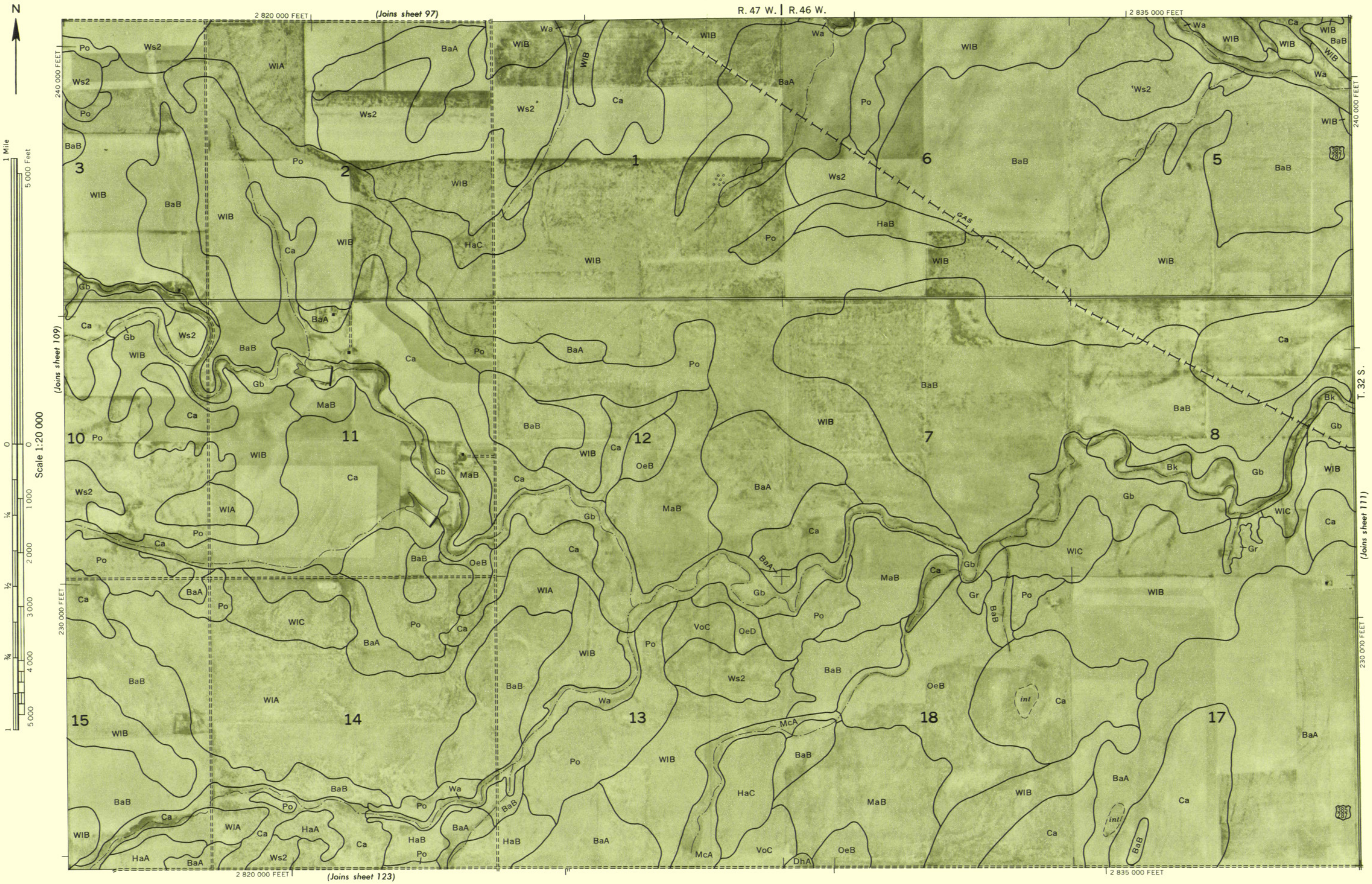
BACA COUNTY, COLORADO NO. 108

BACA COUNTY, COLORADO — SHEET NUMBER 109



BACA COUNTY, COLORADO NO. 109

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station. Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum. Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

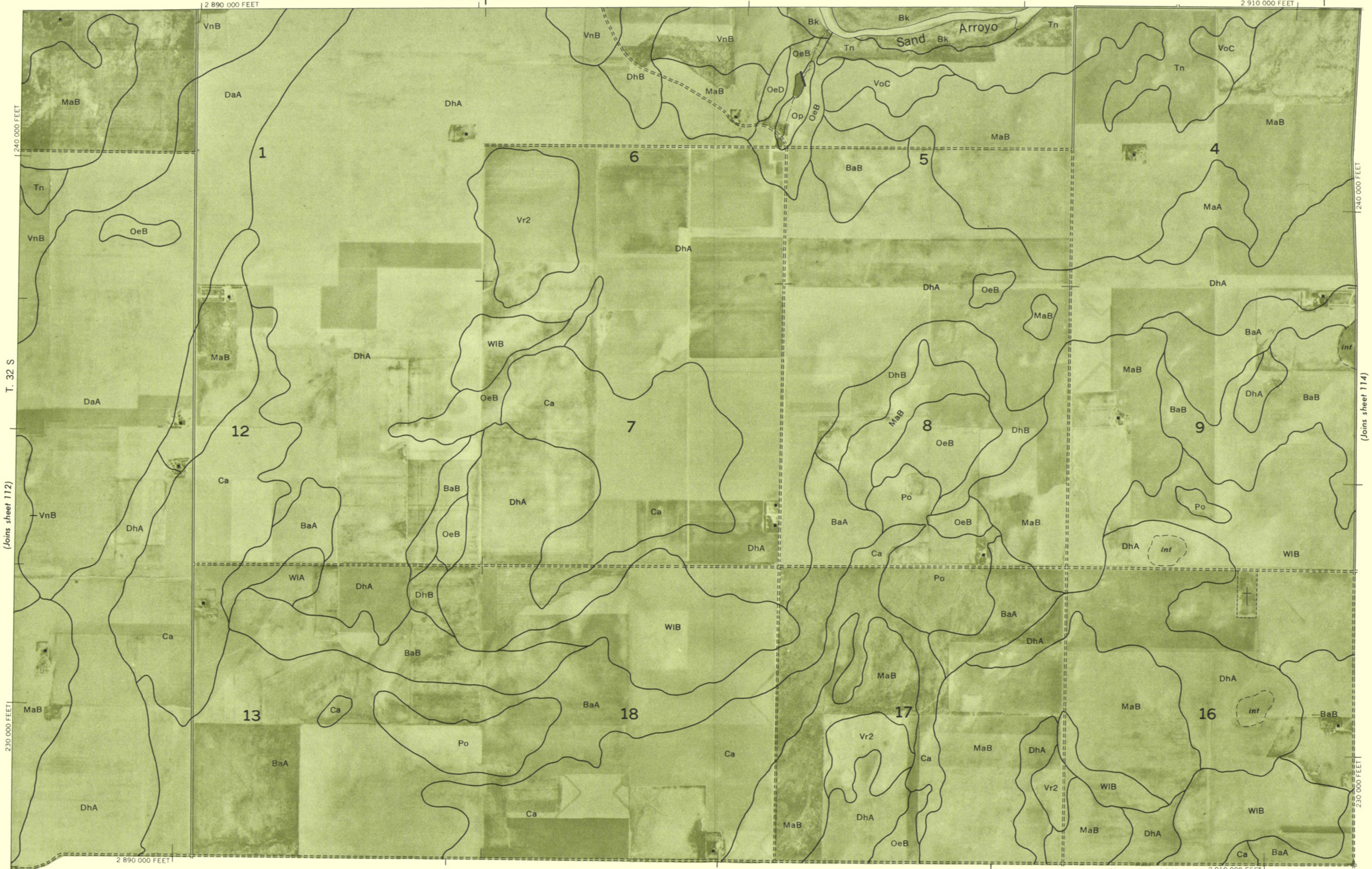
BACA COUNTY, COLORADO NO. 111

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

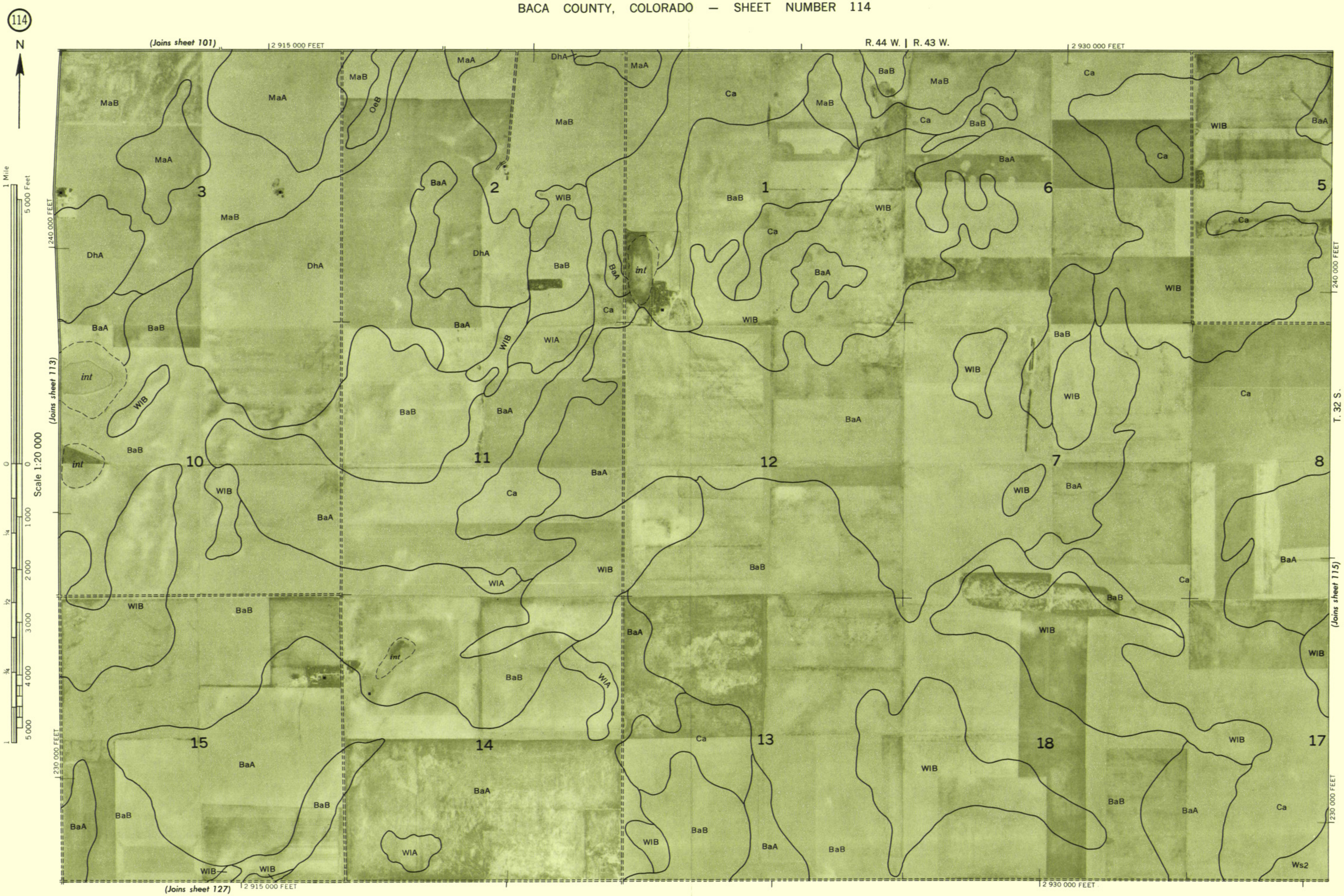


BACA COUNTY, COLORADO NO. 113

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

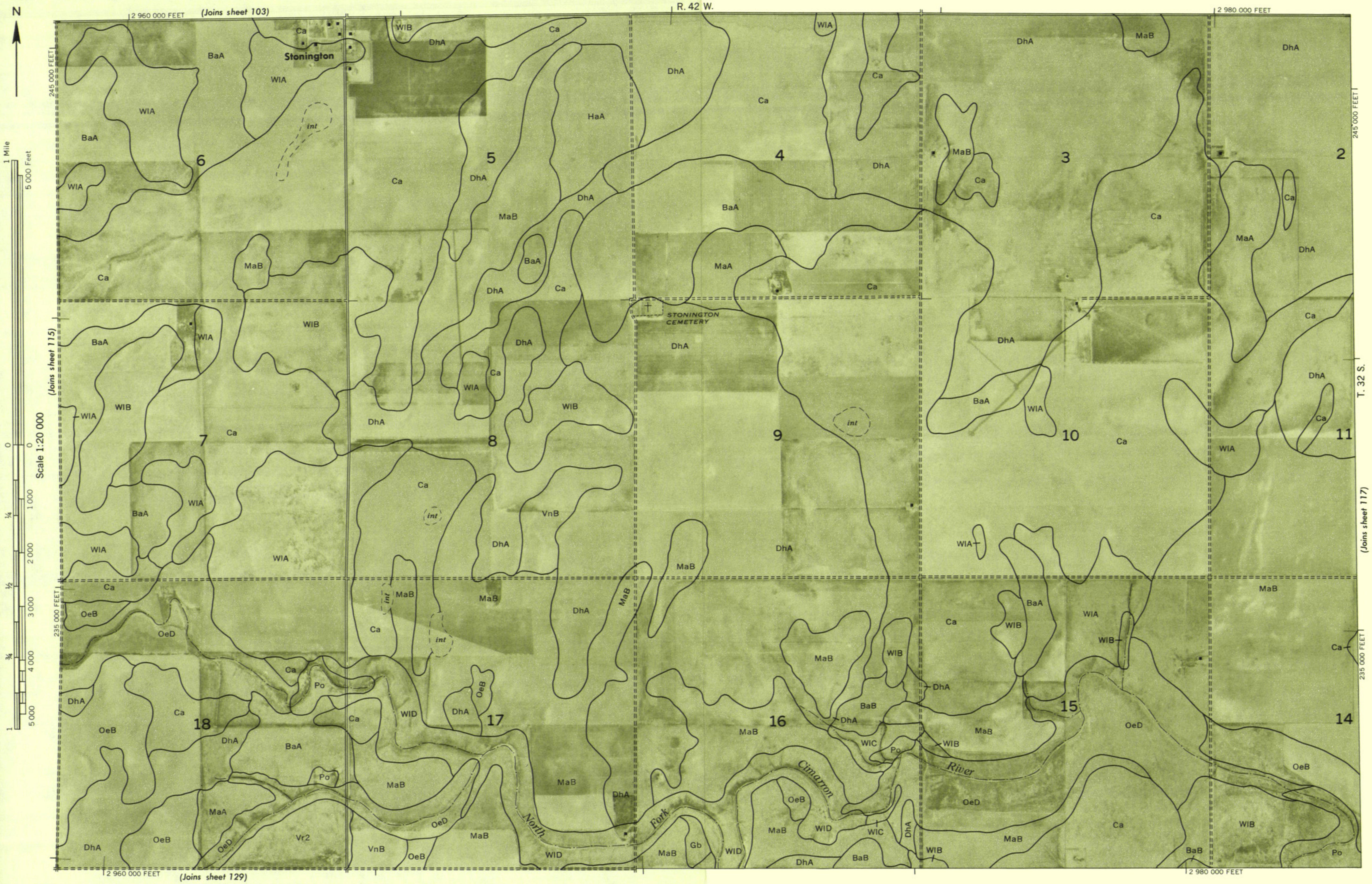
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 115

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 117

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station

BACA COUNTY, COLORADO NO. 119

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 120

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 121

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

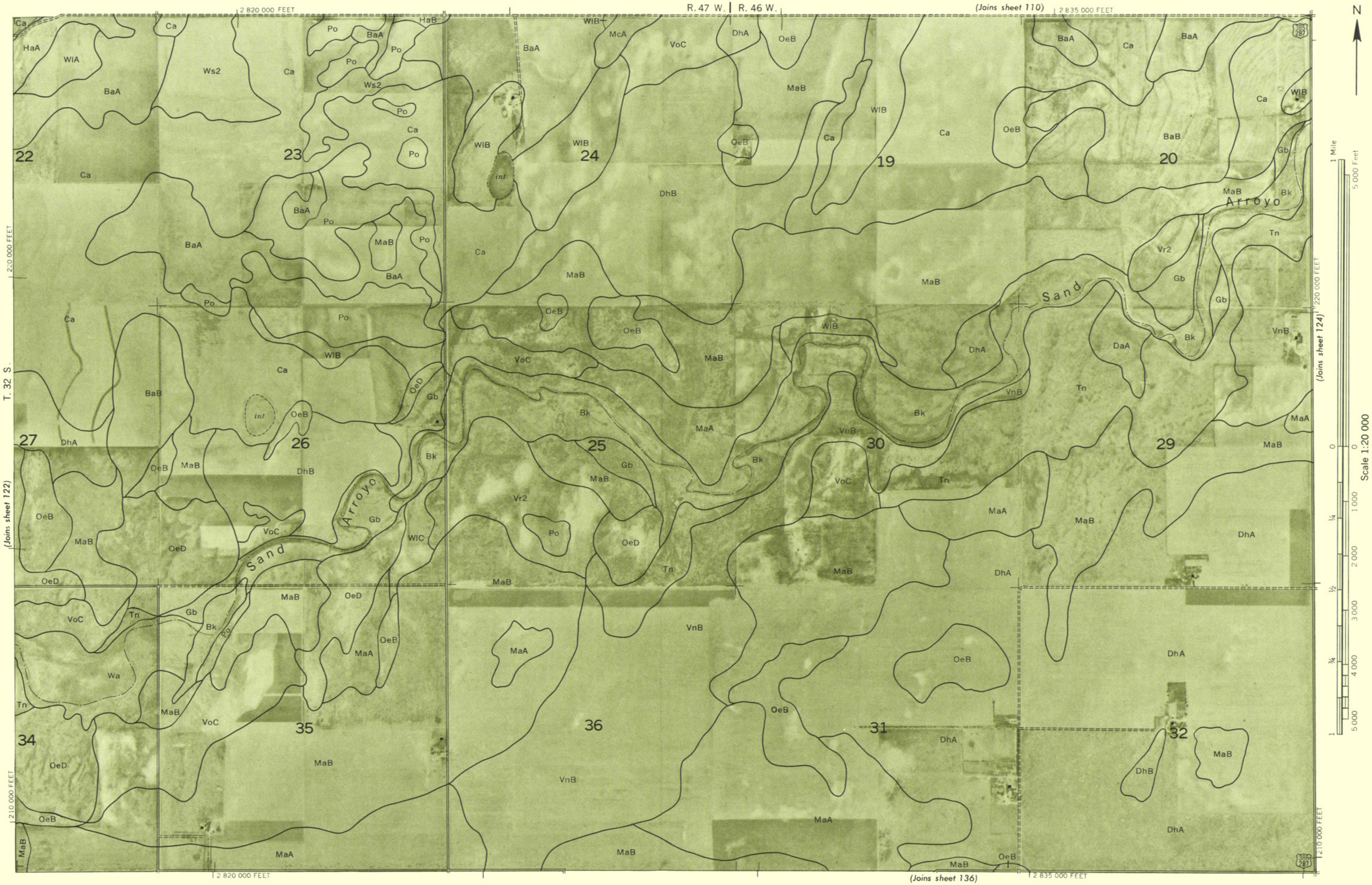
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

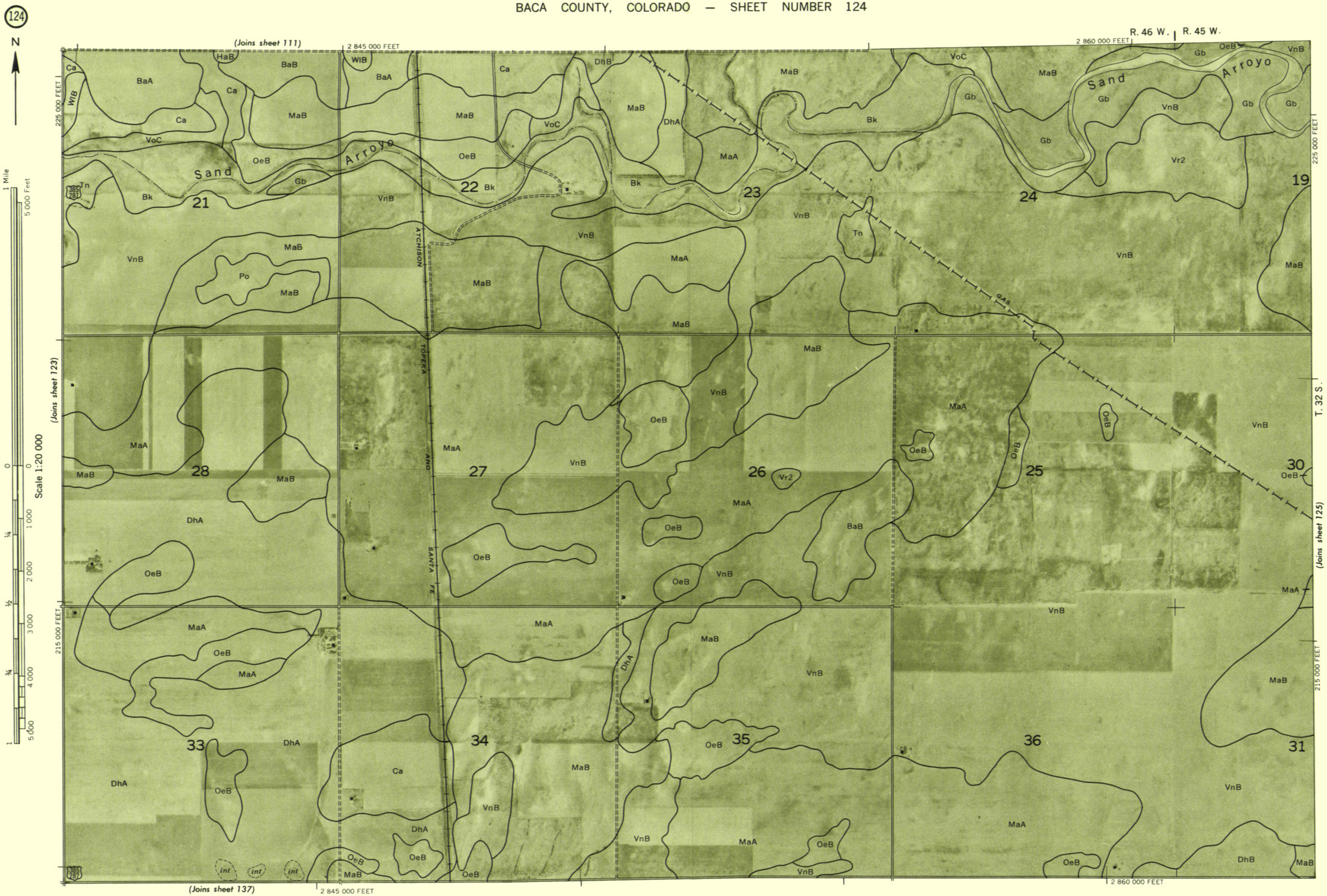
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 123

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 124



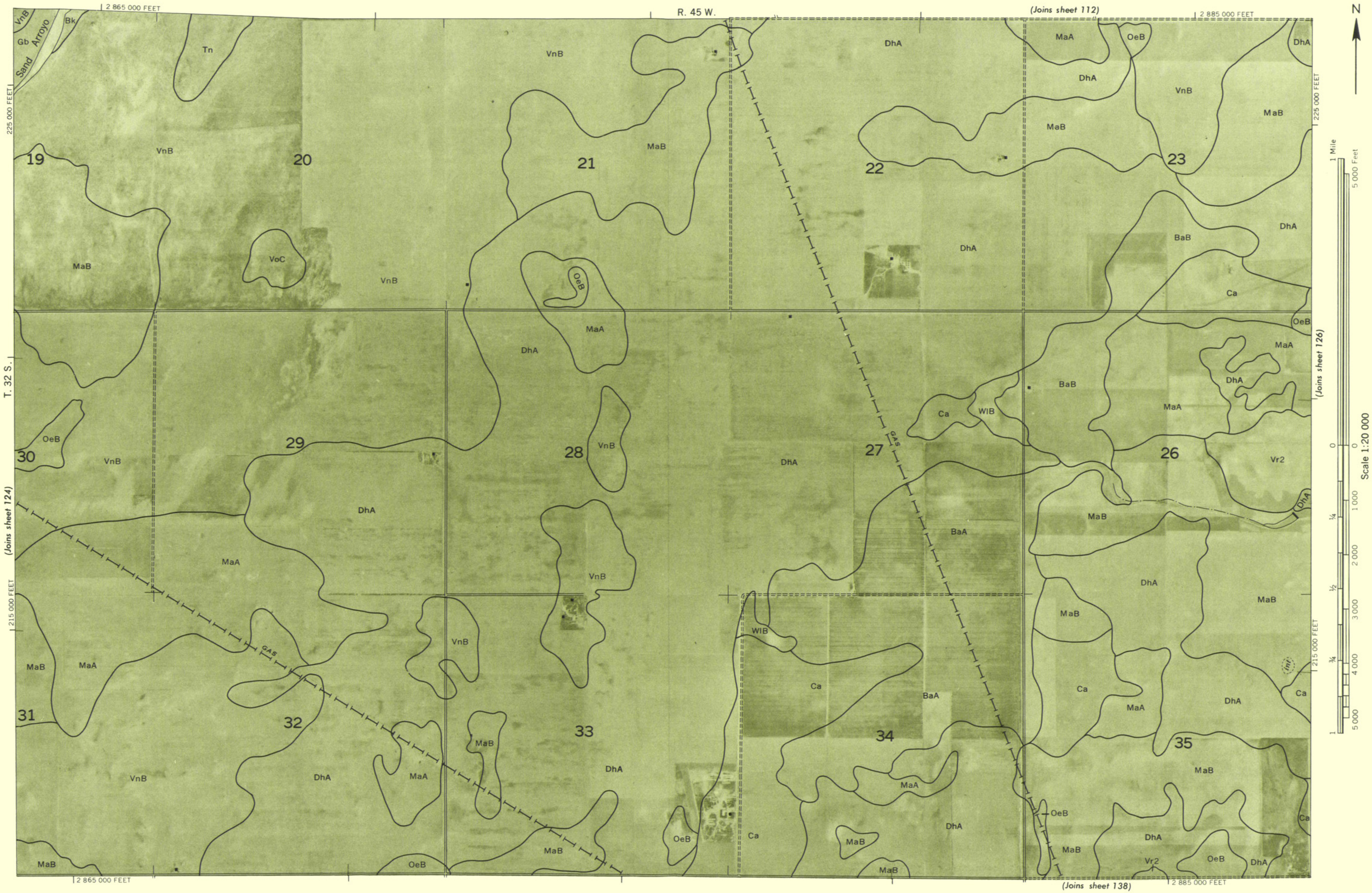
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 124

125



BACA COUNTY, COLORADO NO. 125

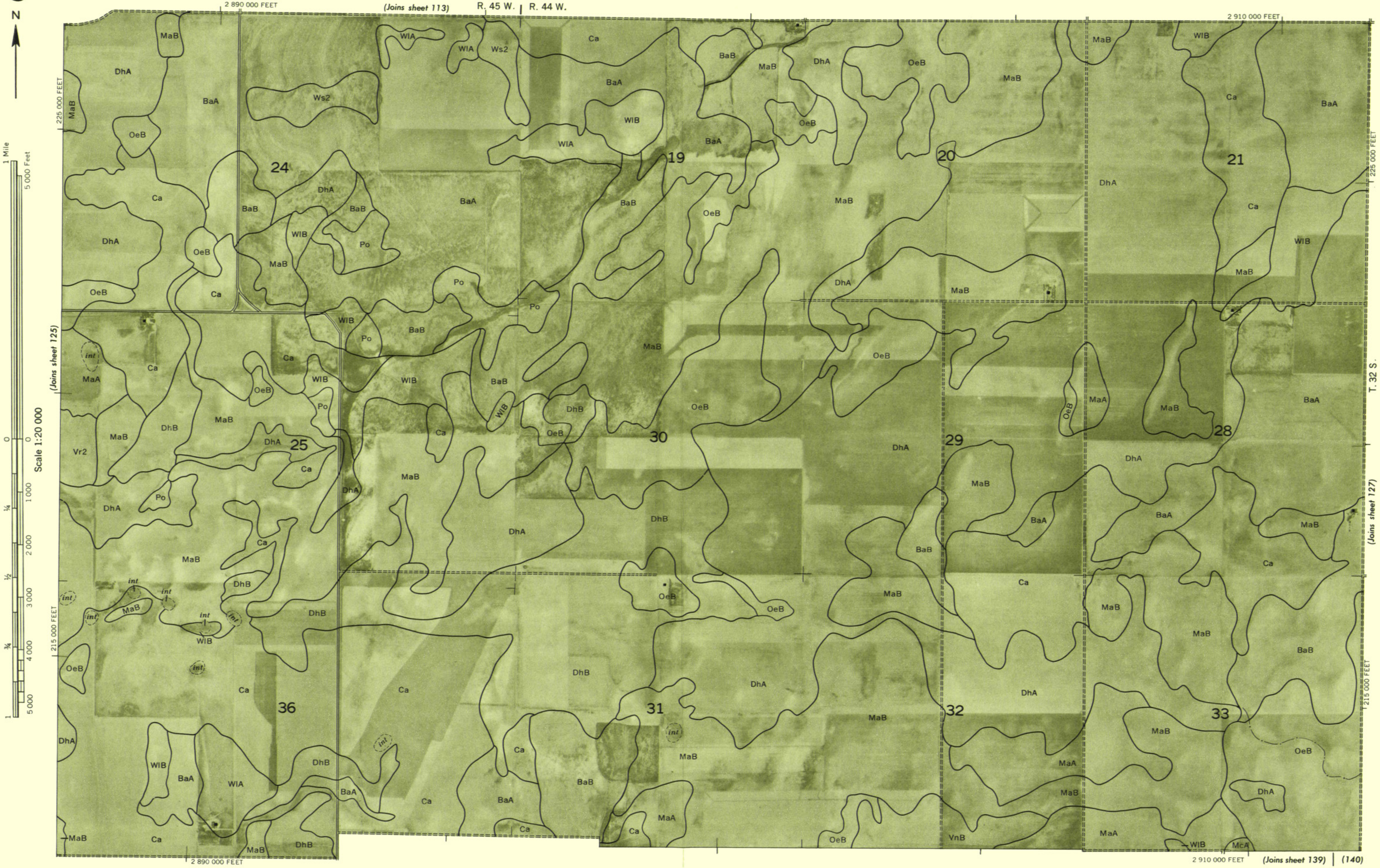
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

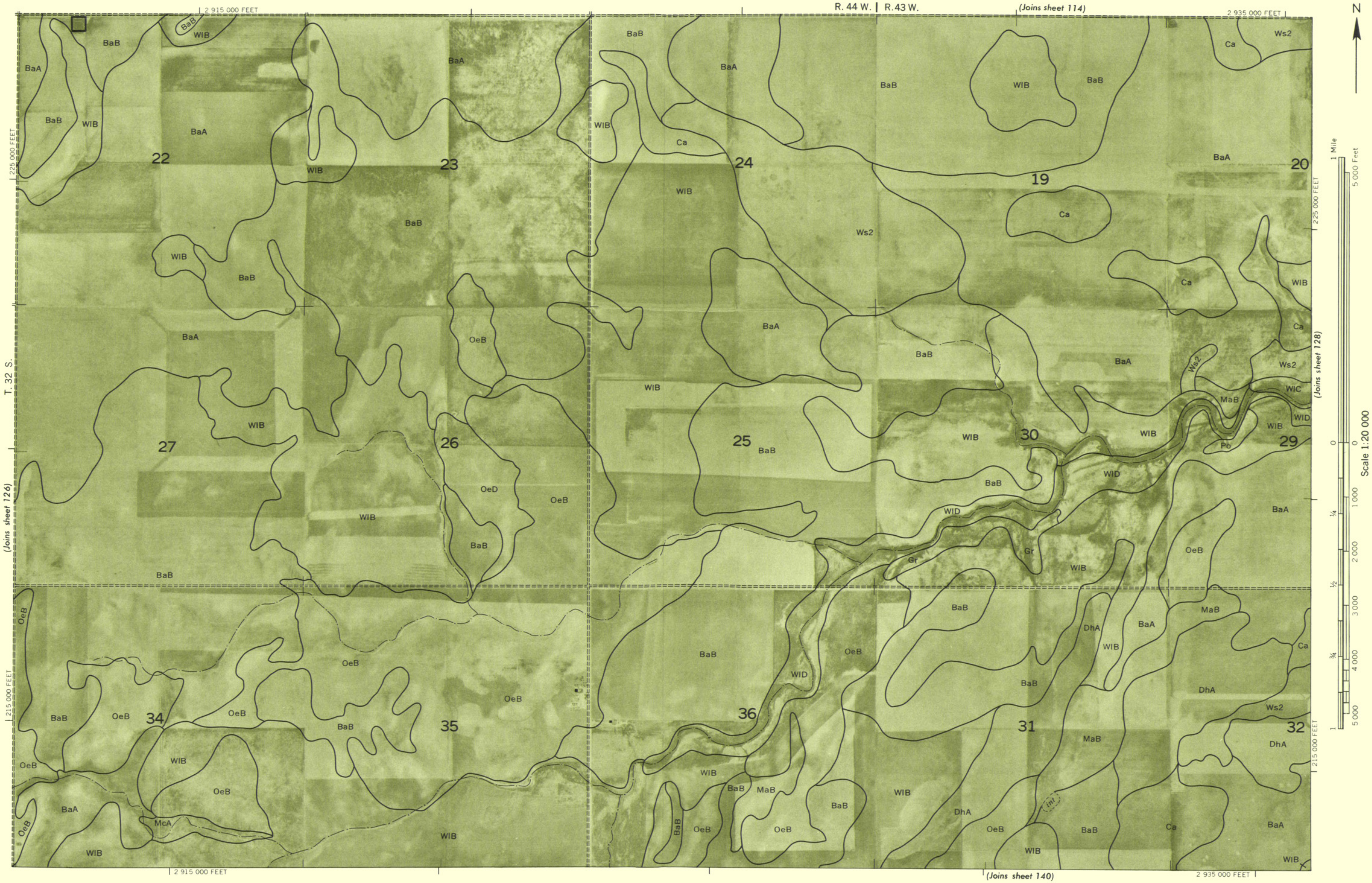
126

BACA COUNTY, COLORADO — SHEET NUMBER 126



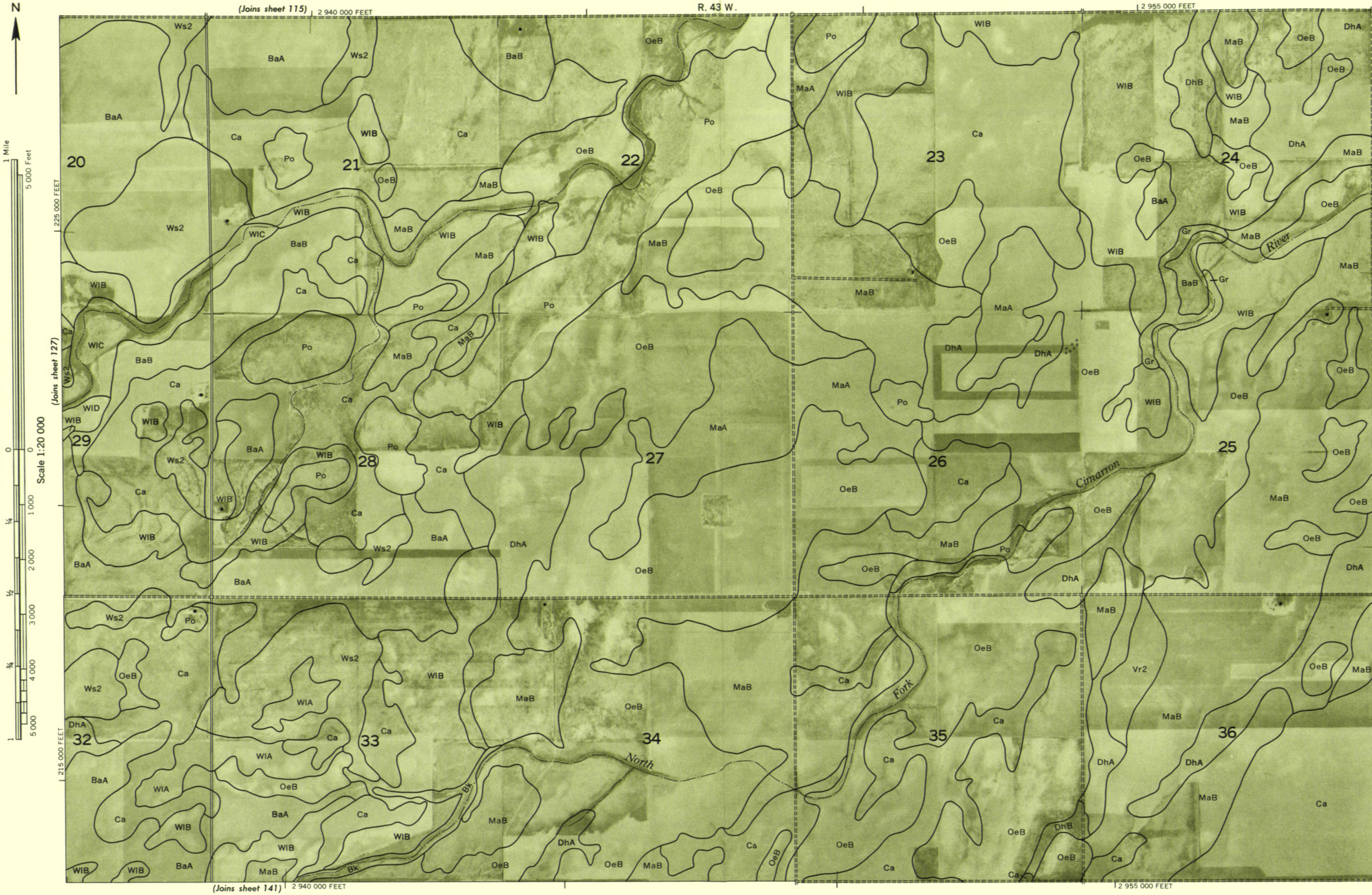
Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 126



BACA COUNTY, COLORADO NO. 127
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 128



Land division corners are approximately positioned on this map.

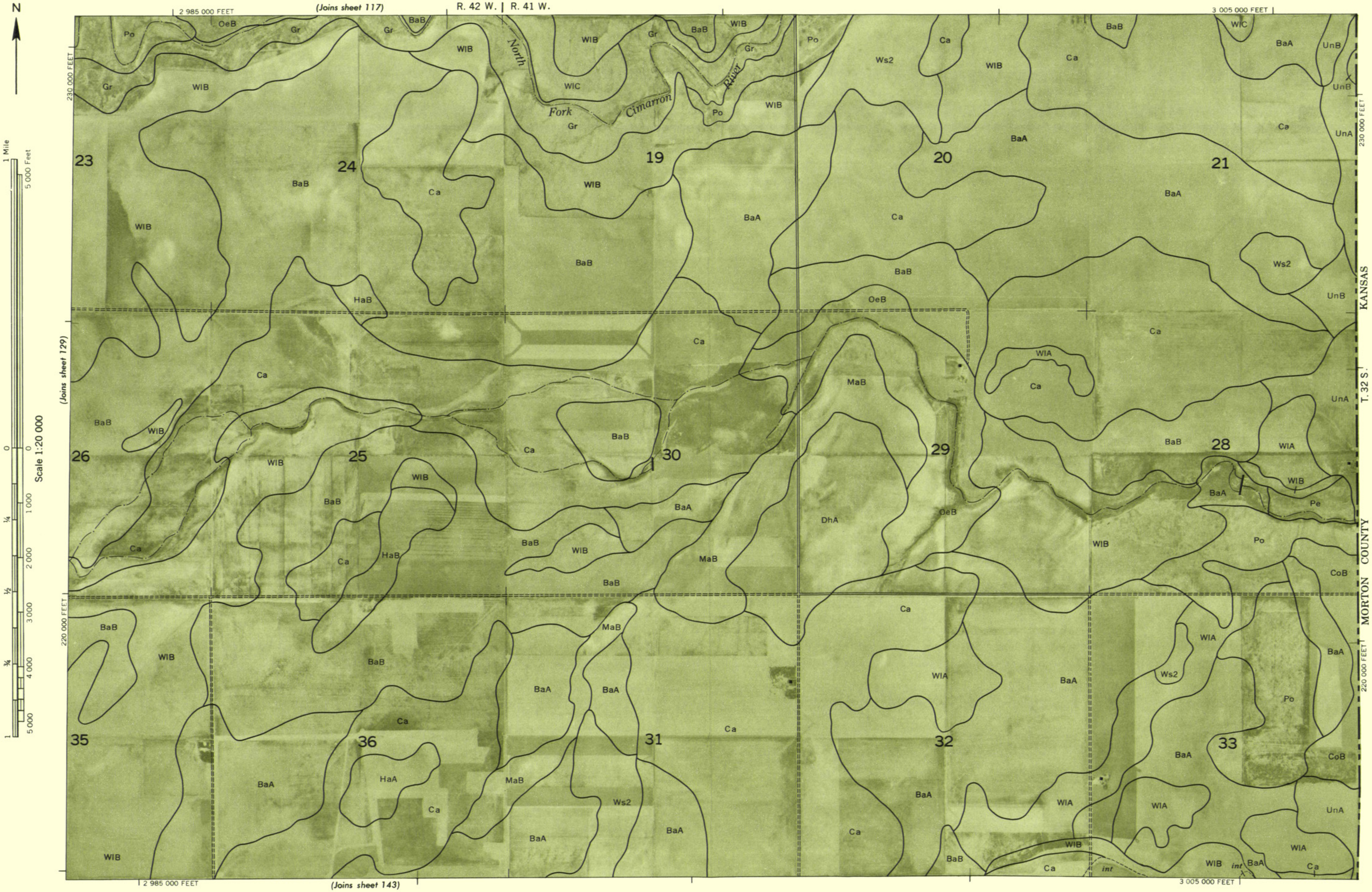
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

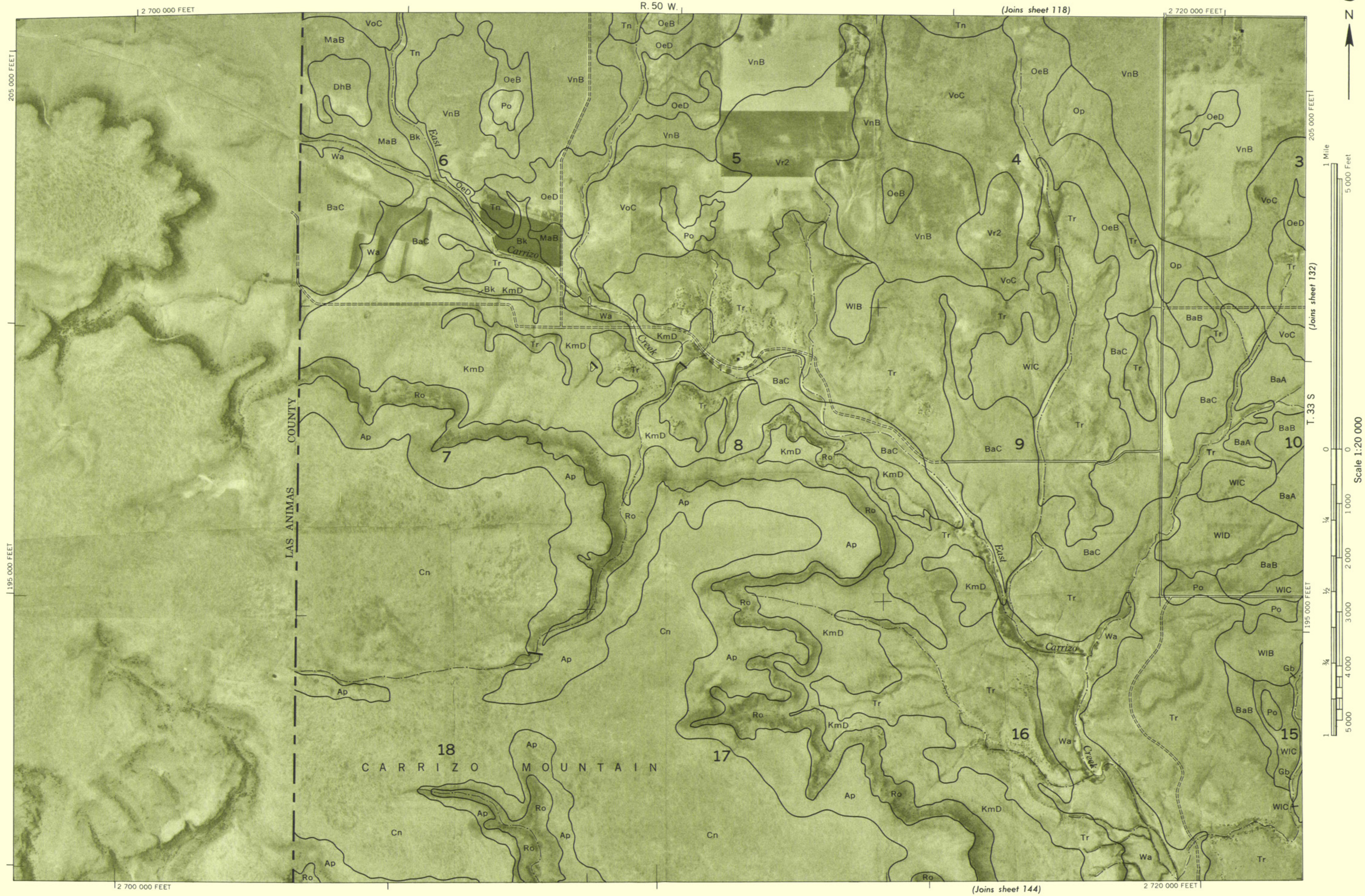
BACA COUNTY, COLORADO NO. 128

BACA COUNTY, COLORADO NO. 129

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



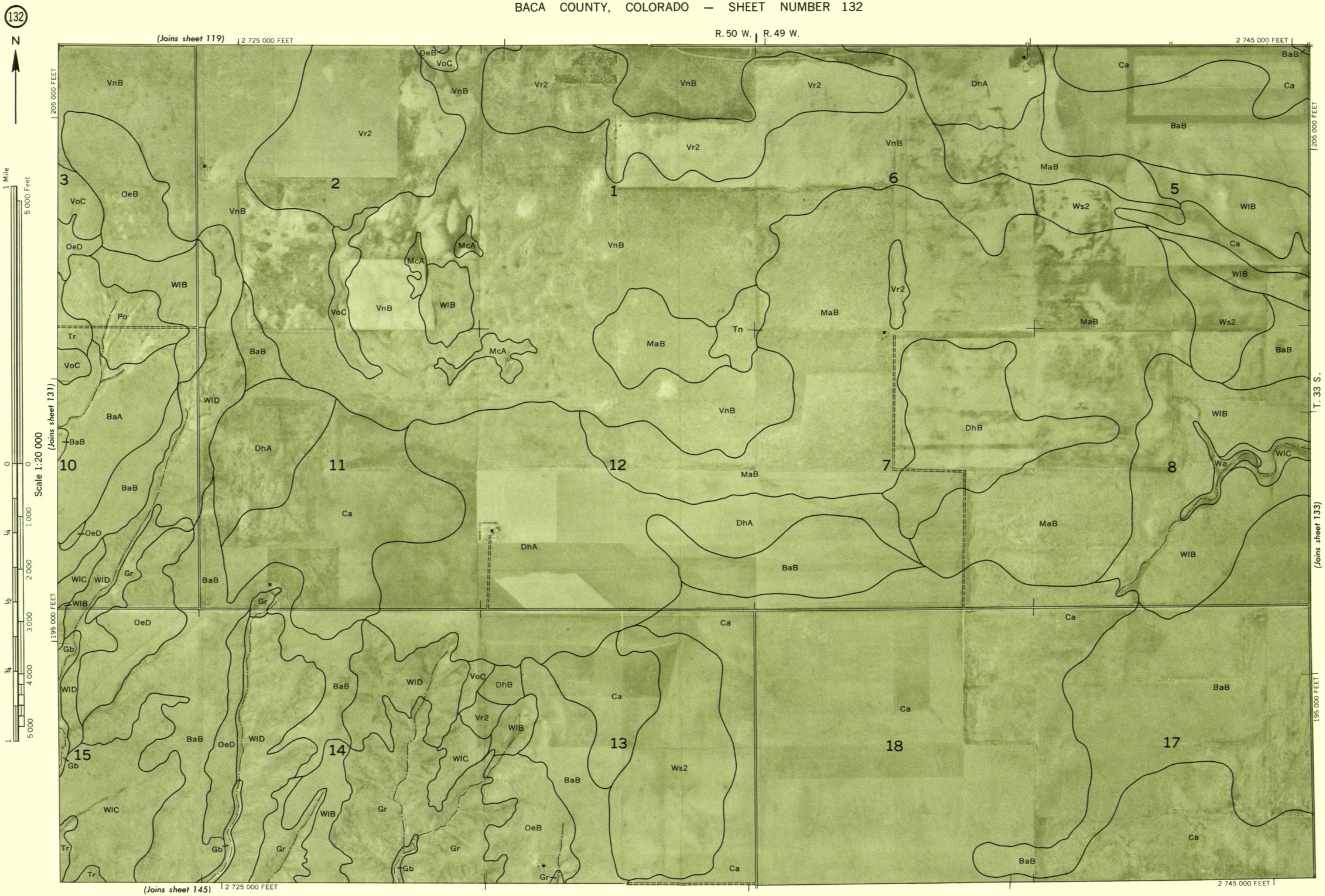
Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 131

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 132



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 132

BACA COUNTY COLORADO NO. 133

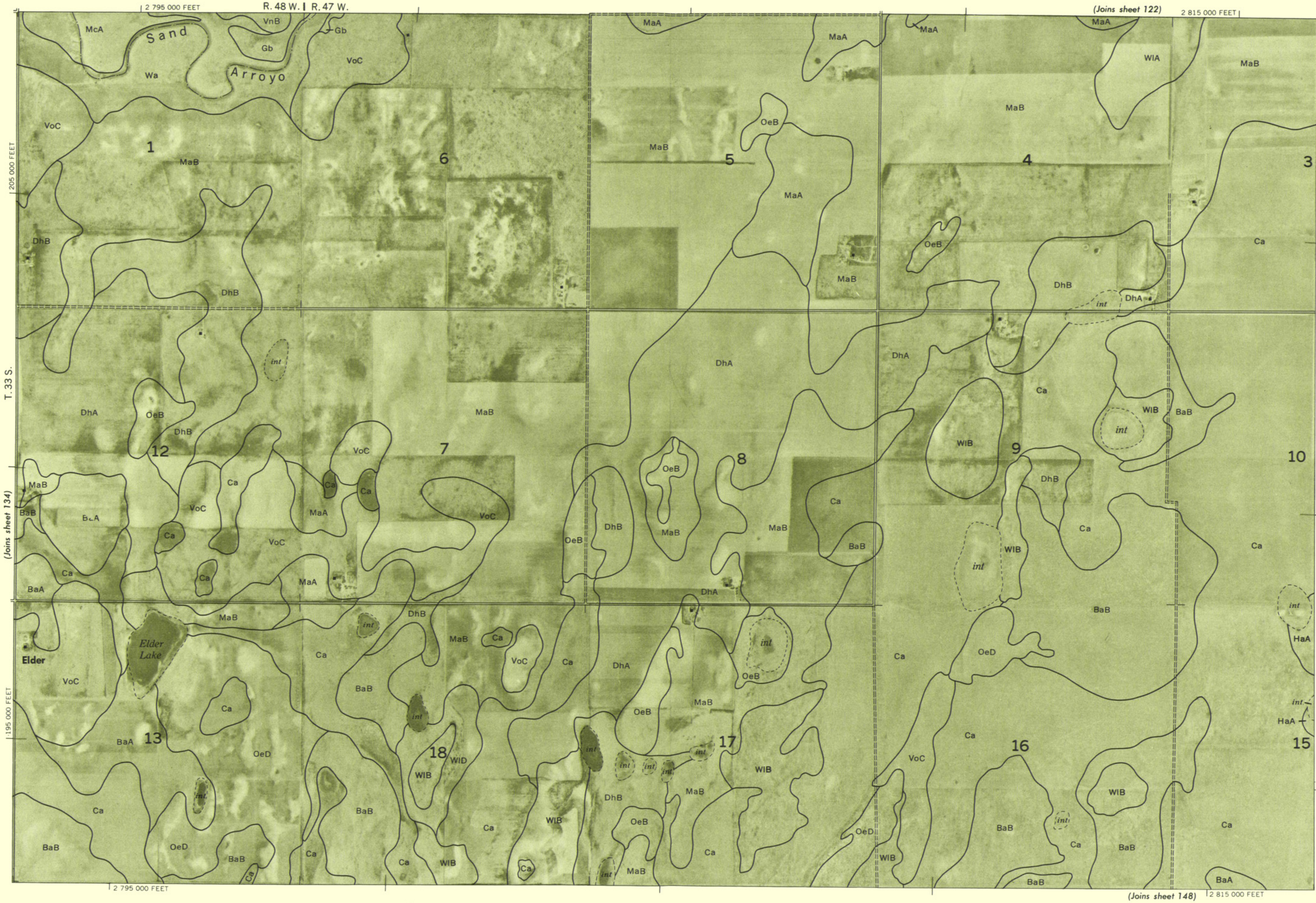
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone, 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 134

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



N

Scale 1:20 000

1 Mile

5 000 Feet

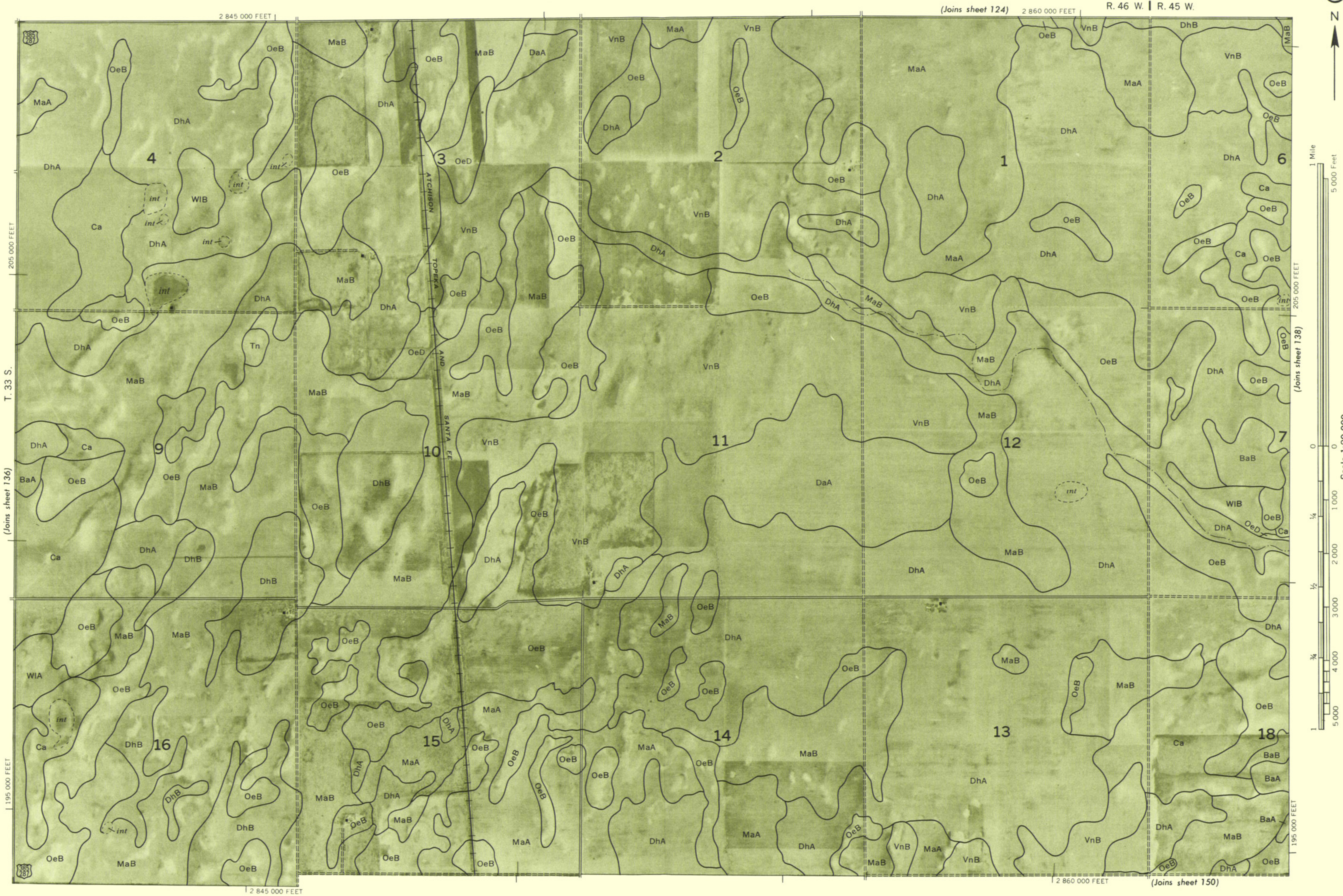
BACA COUNTY, COLORADO NO. 135

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 137

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

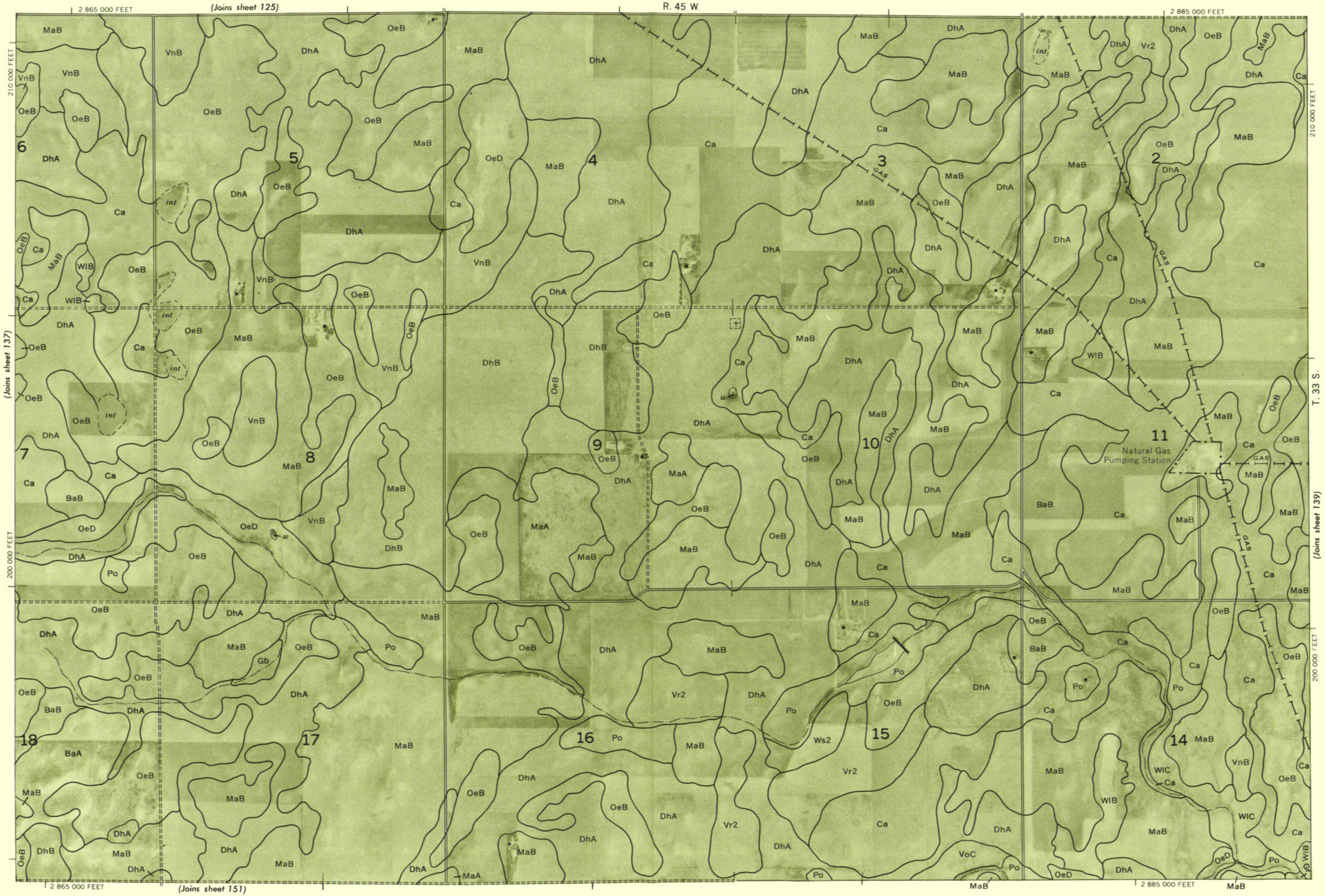
Land division corners are approximately positioned on this map.

N

1 Mile

5 000 Feet

Scale 1:20 000



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

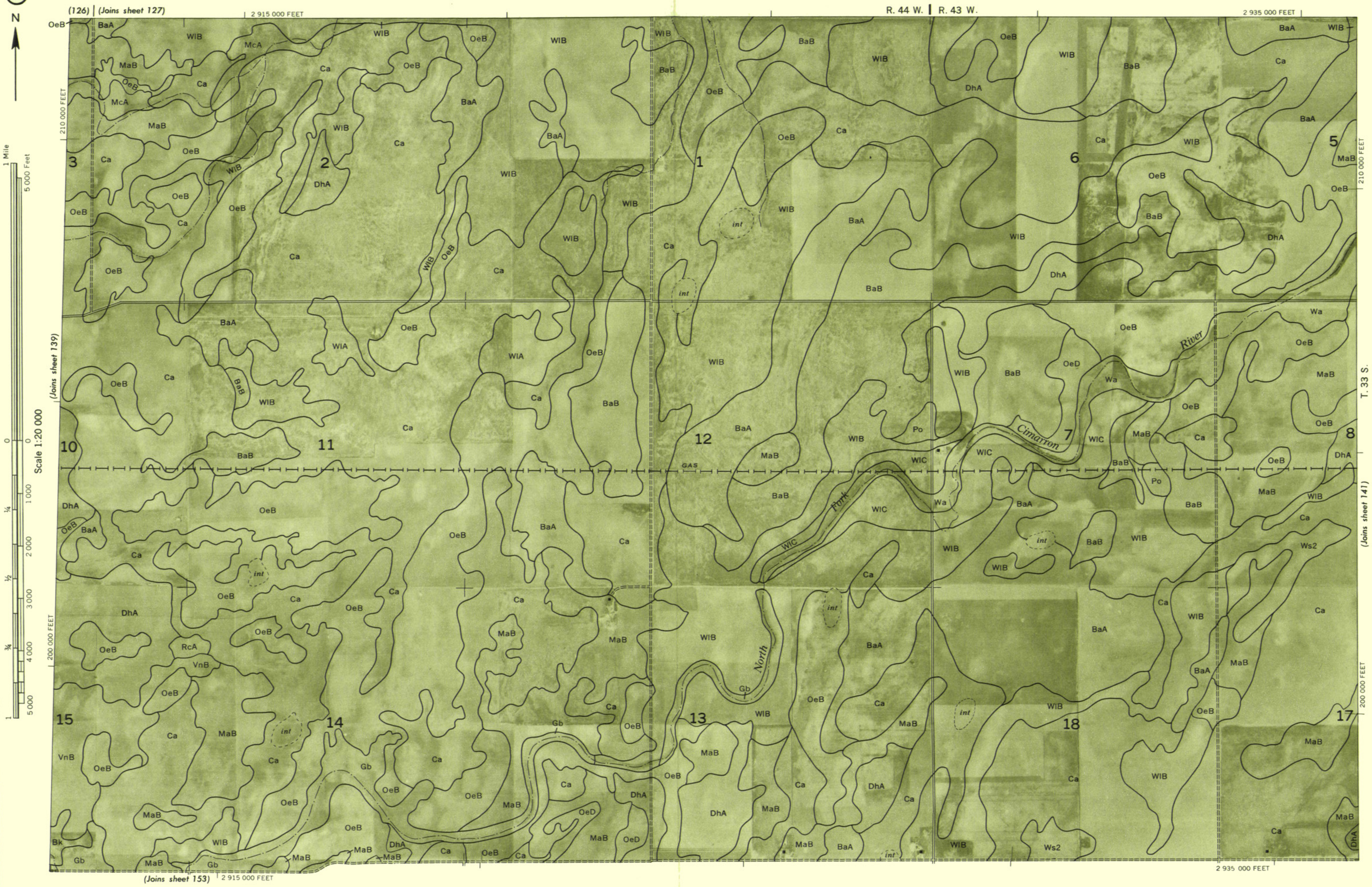
Scale 1:20 000

1 Mile

5 000 Feet

BACA COUNTY, COLORADO NO. 139

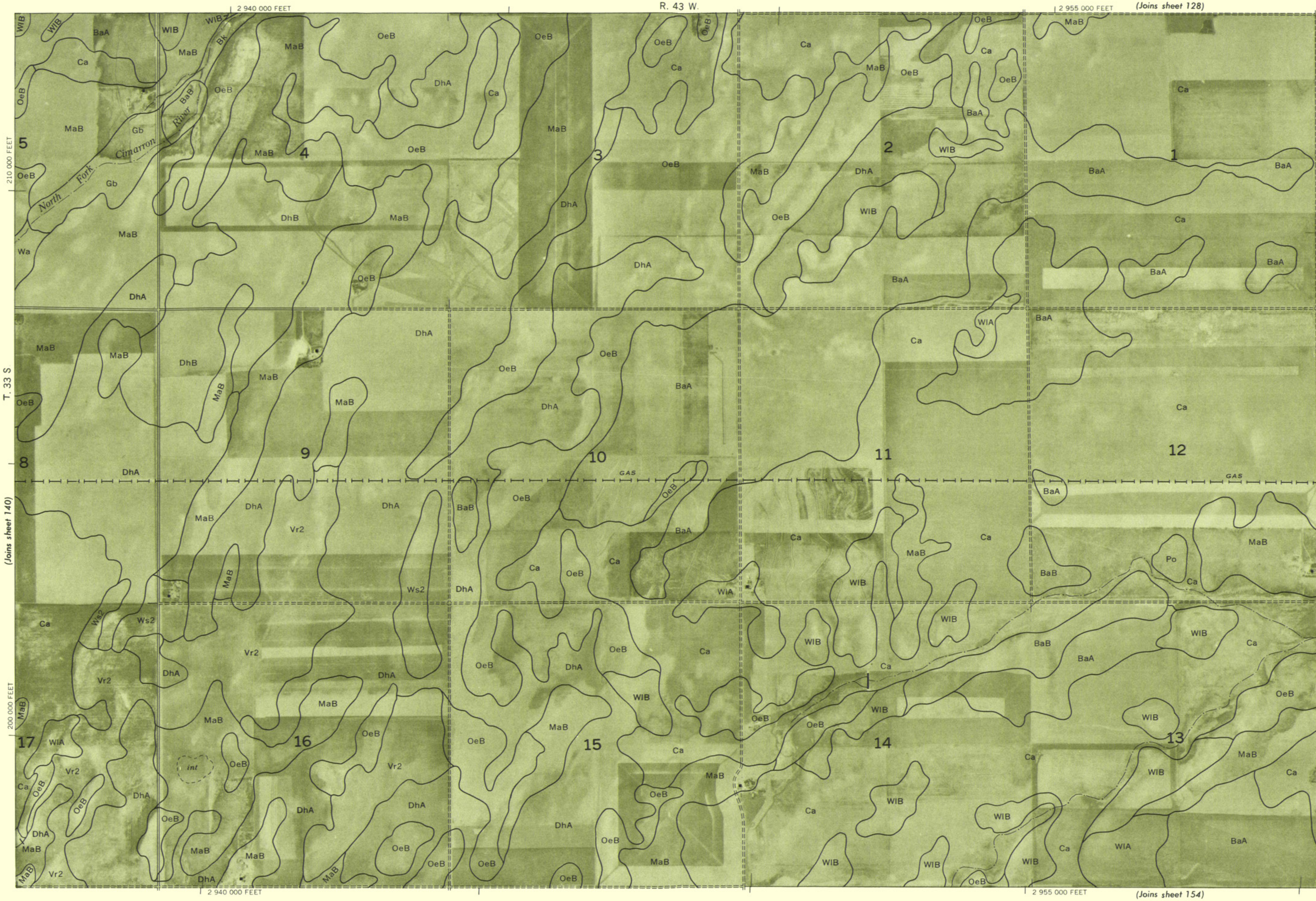
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



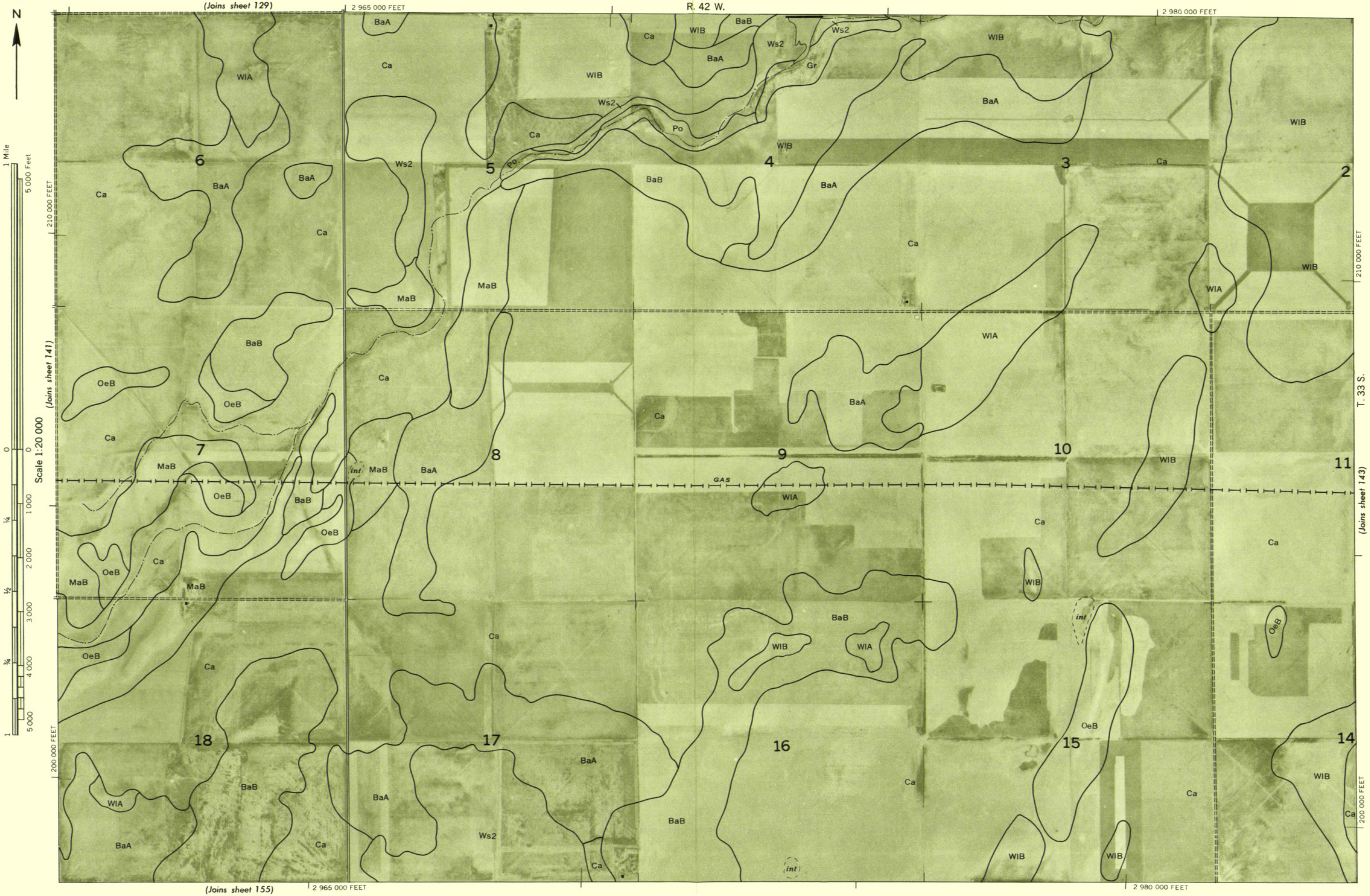
N

1 Mile
5 000 Feet
Scale 1:20 000

BACA COUNTY, COLORADO NO. 141

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 142



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 143
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 144

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

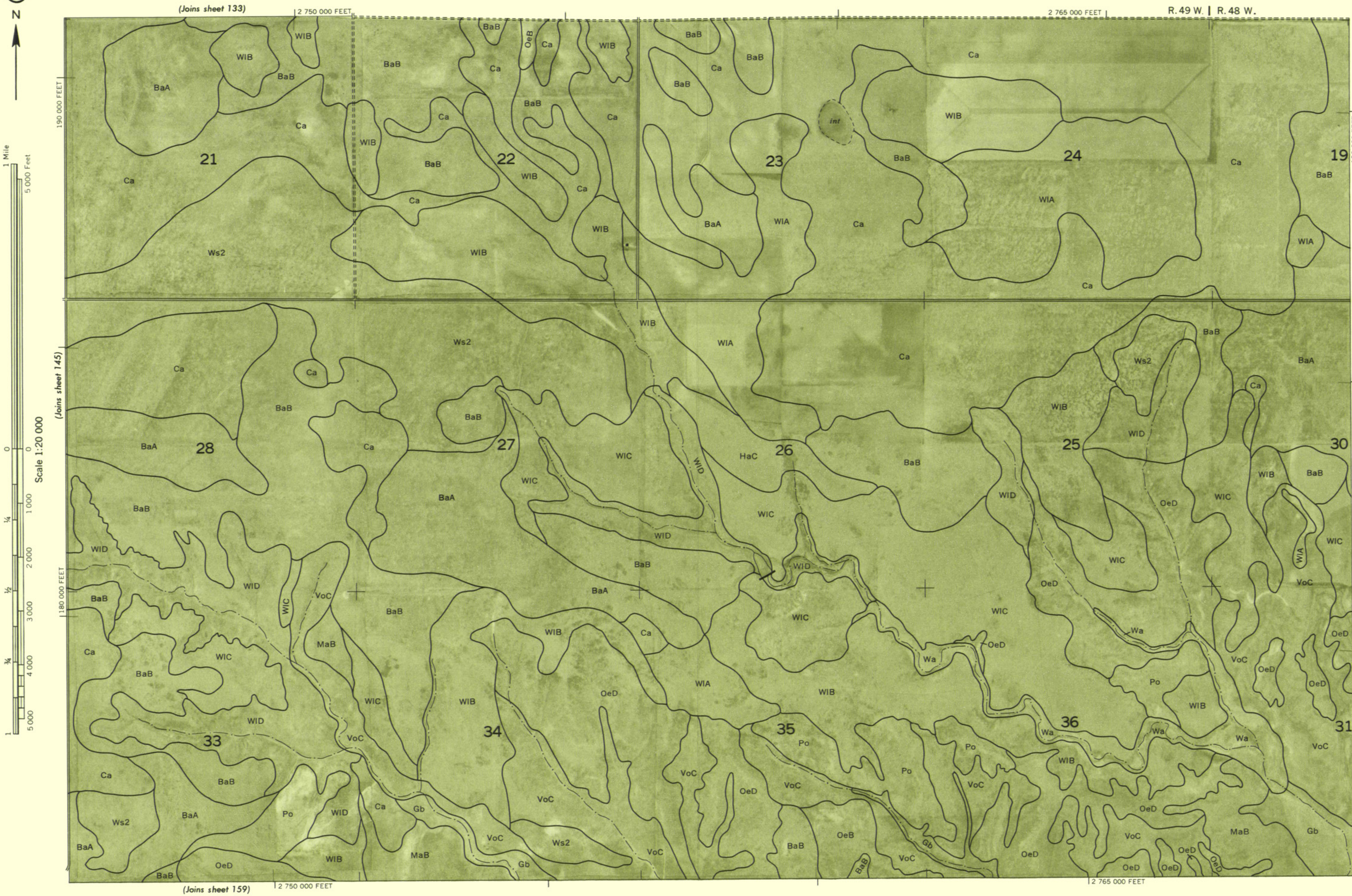
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

145

BACA COUNTY, COLORADO NO. 145

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 146



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

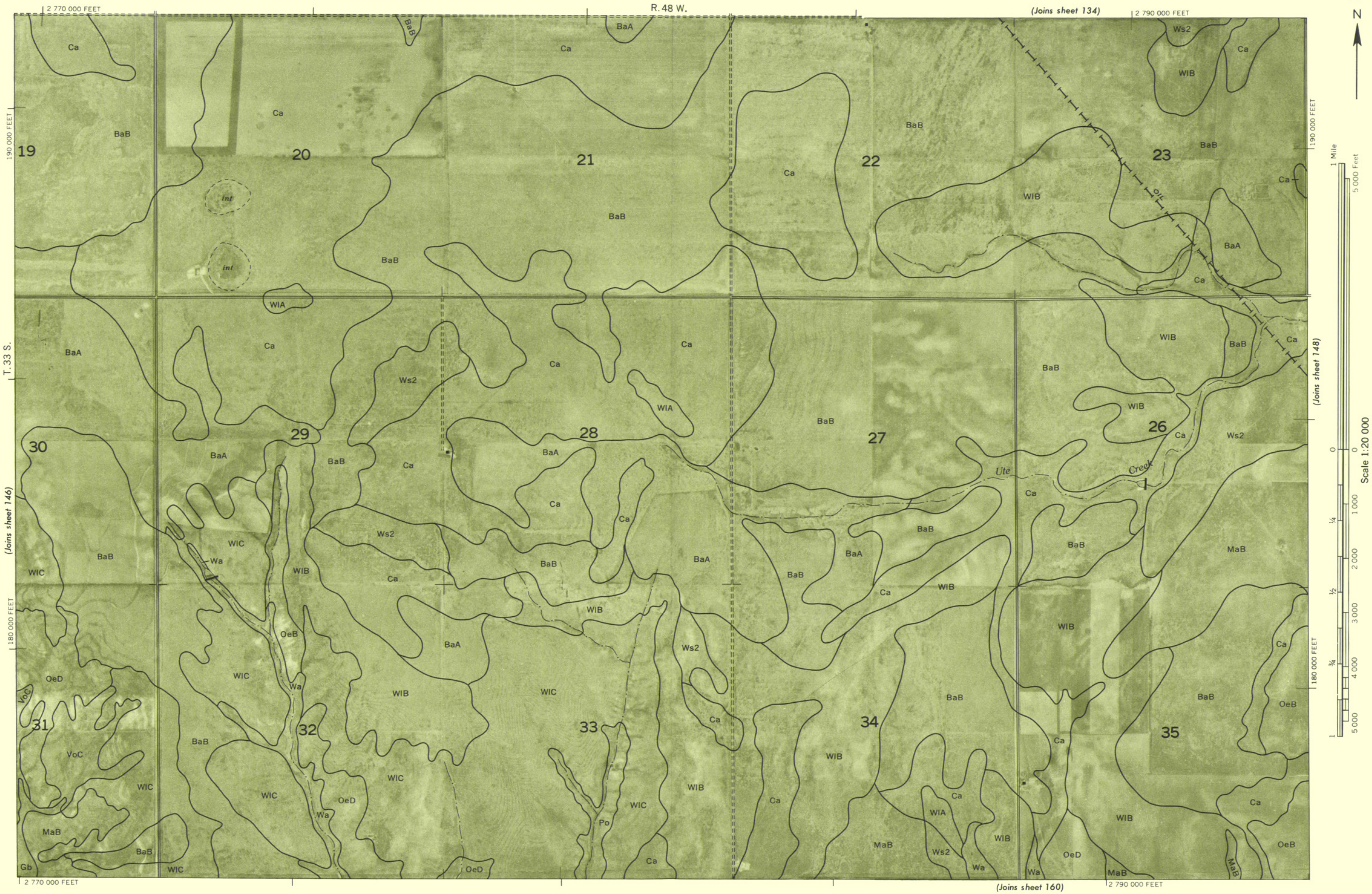
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 147

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.



BACA COUNTY, COLORADO — SHEET NUMBER 148

N

Scale 1:20 000

1 Mile | 5 000 Feet | 0 | ¼ | ½ | ¾ | 1 | 0 | 1000 | 2000 | 3000 | 4000 | 5000

Land division corners are approximately positioned on this map.

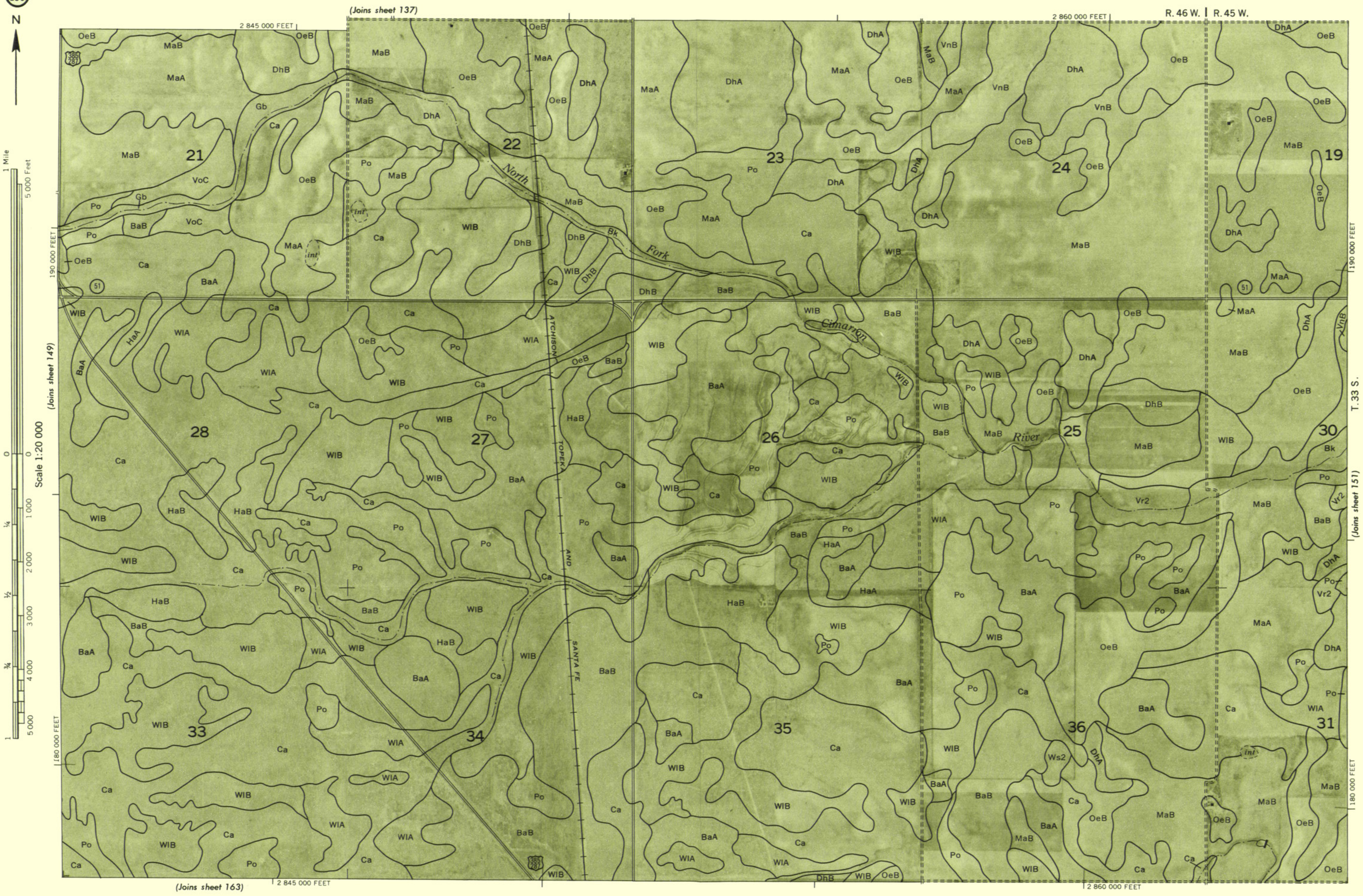
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 149

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 150



BACA COUNTY, COLORADO NO. 150

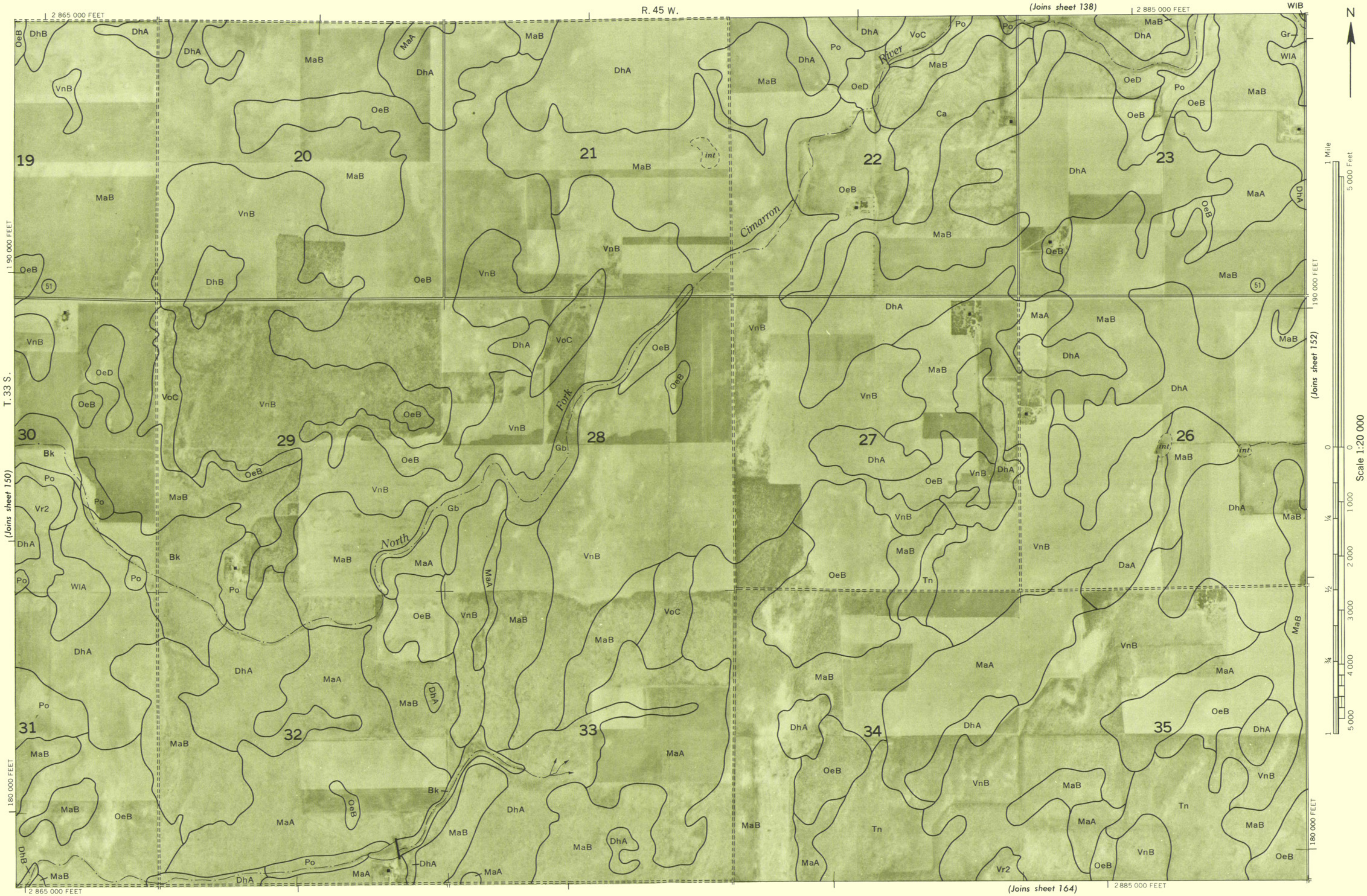
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 151

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

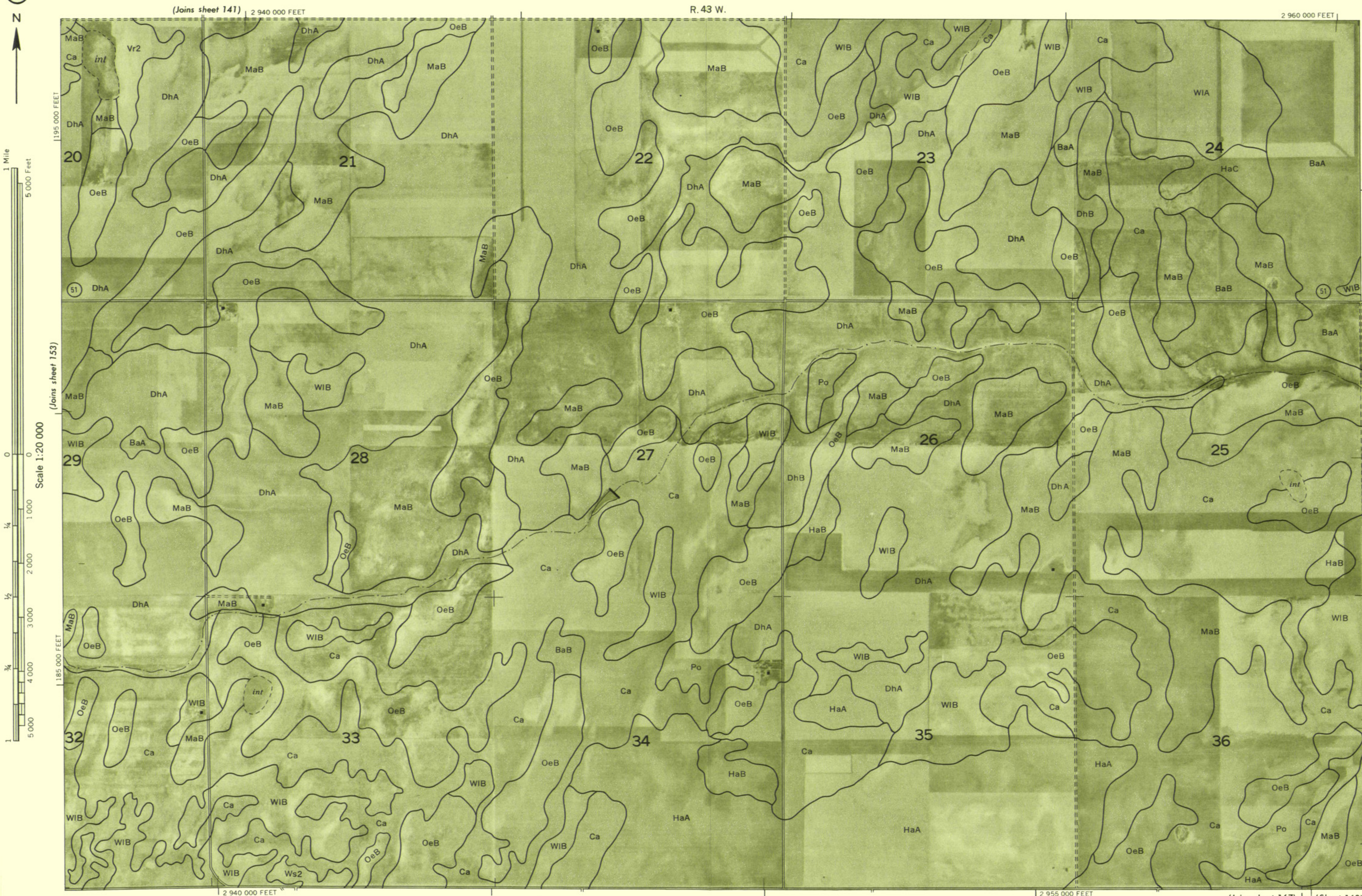
BACA COUNTY, COLORADO — SHEET NUMBER 153

153

BACA COUNTY, COLORADO NO. 153

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 154



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

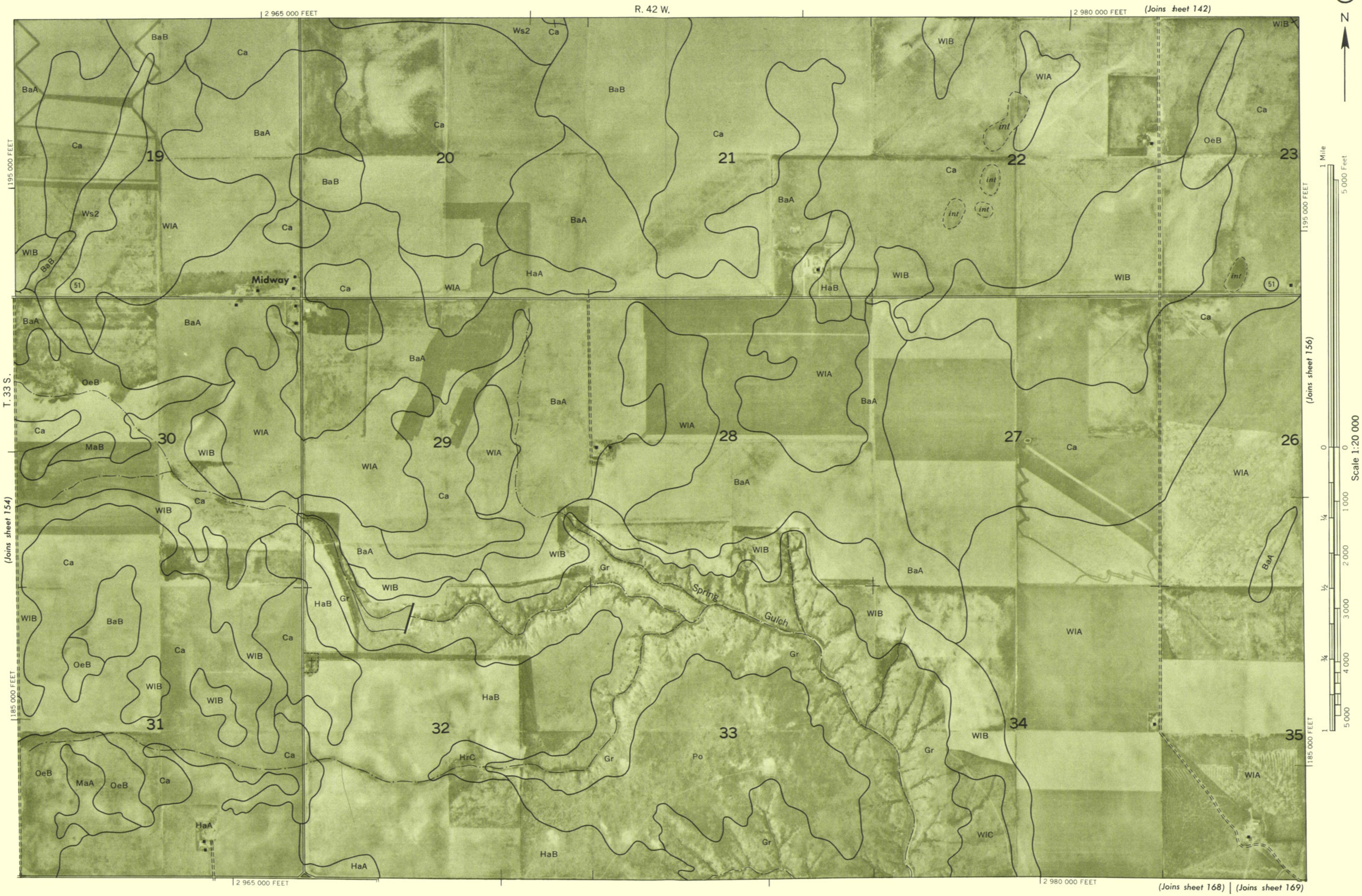
BACA COUNTY, COLORADO NO. 154

BACA COUNTY, COLORADO NO. 155

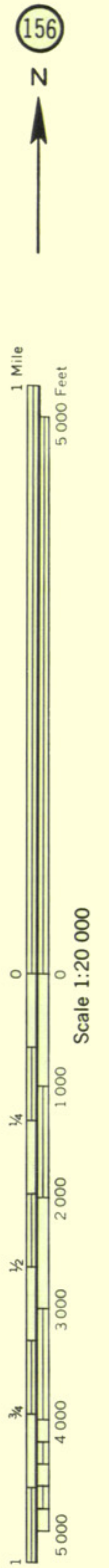
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

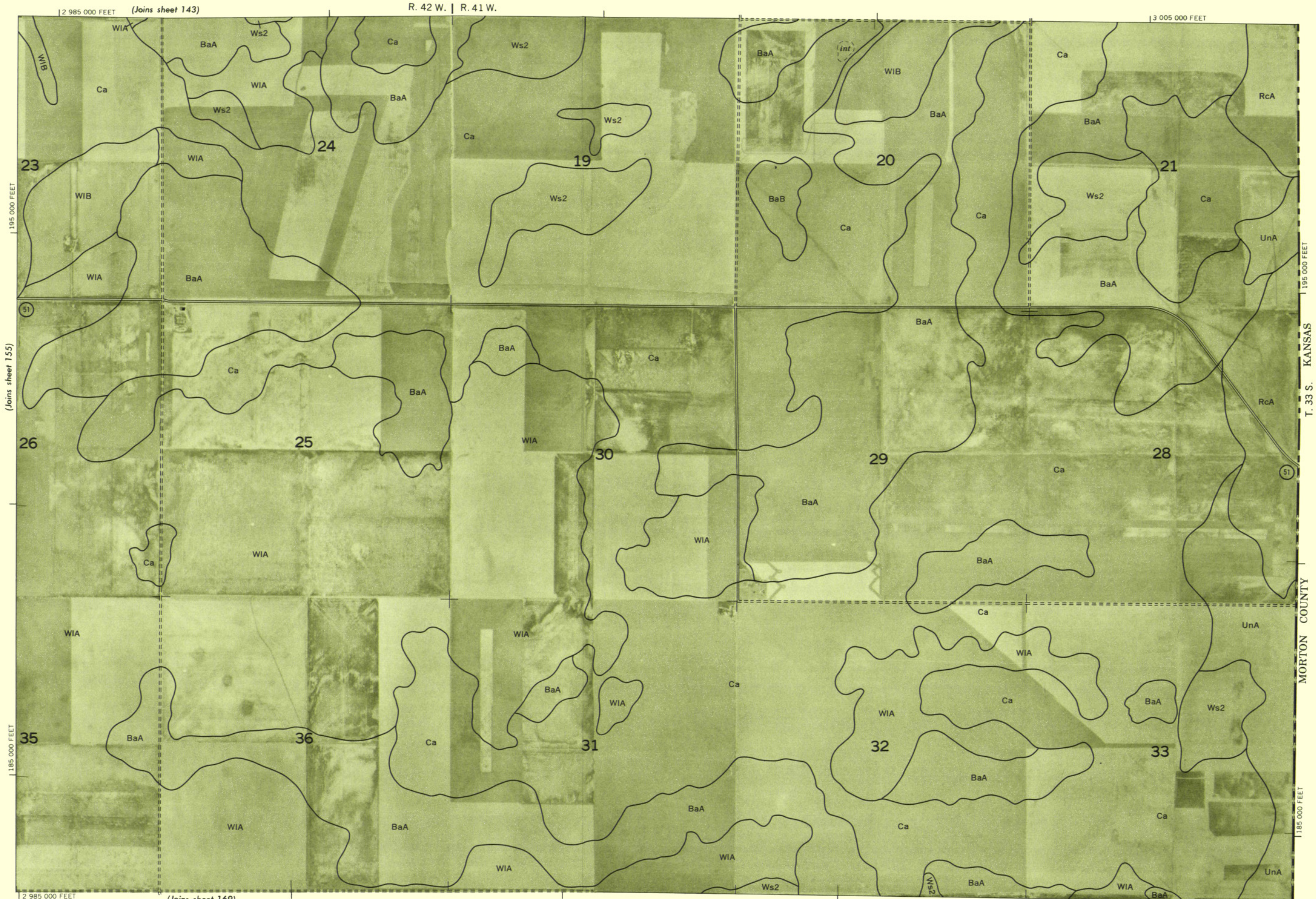
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.



BACA COUNTY, COLORADO — SHEET NUMBER 156





Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

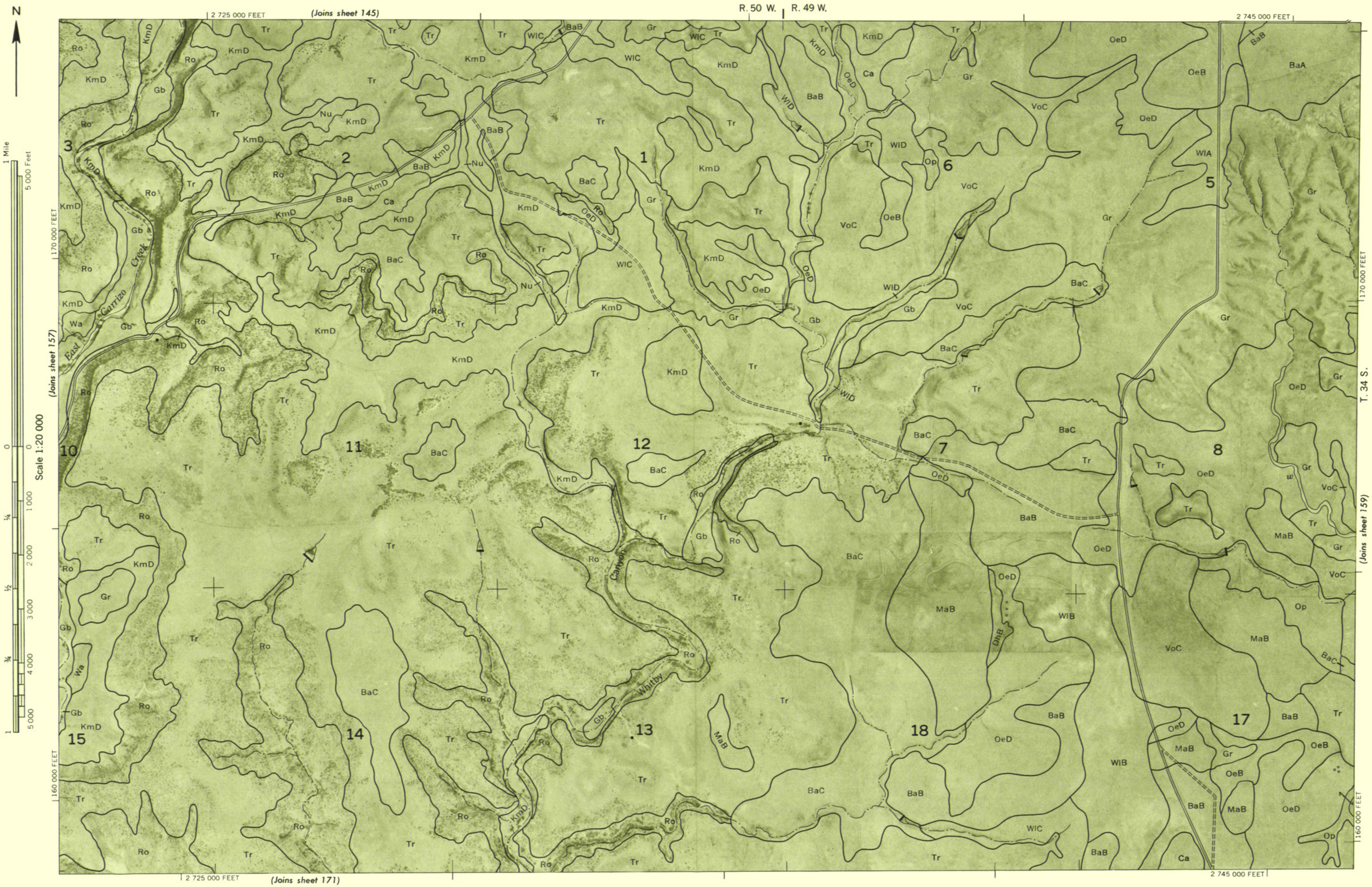
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 156

157

BACA COUNTY, COLORADO NO. 157

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 158

159

BACA COUNTY, COLORADO NO. 159

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 160

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

161

BACA COUNTY, COLORADO NO. 161

This map is one of a set compiled in **1970 as part of a** soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

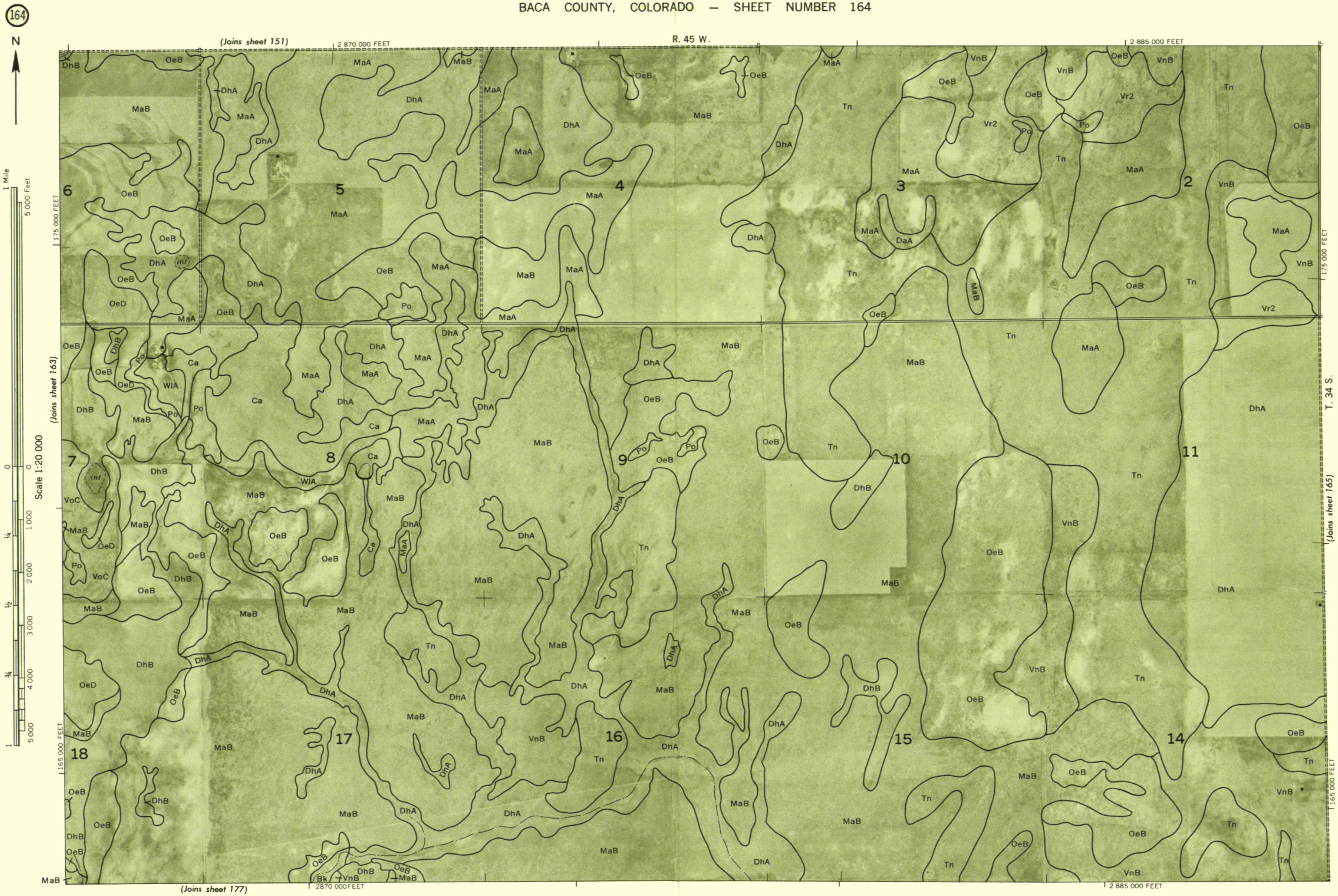
BACA COUNTY, COLORADO — SHEET NUMBER 162

Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 162

BACA COUNTY, COLORADO NO. 163

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 165

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 166

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 167

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 168

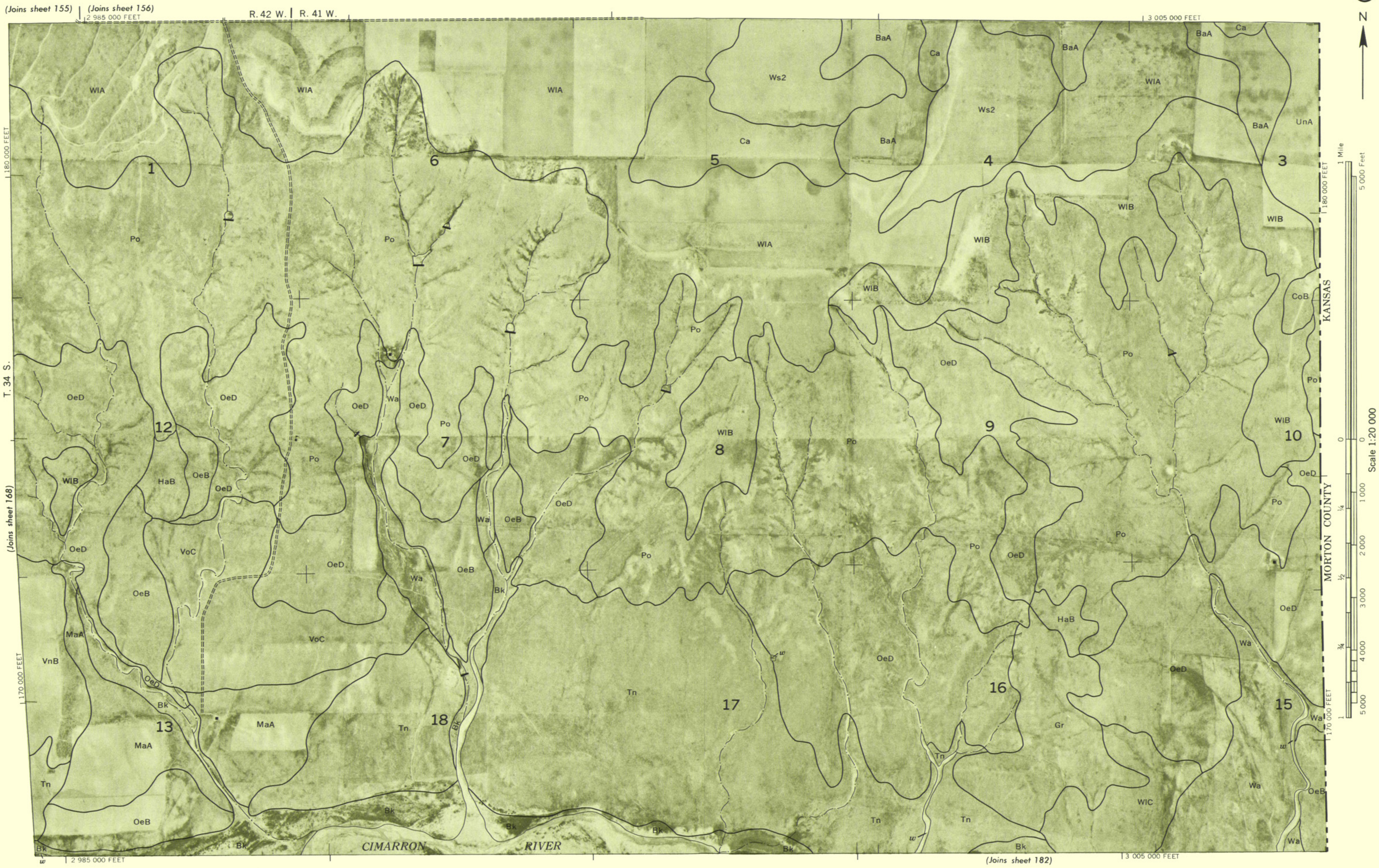
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

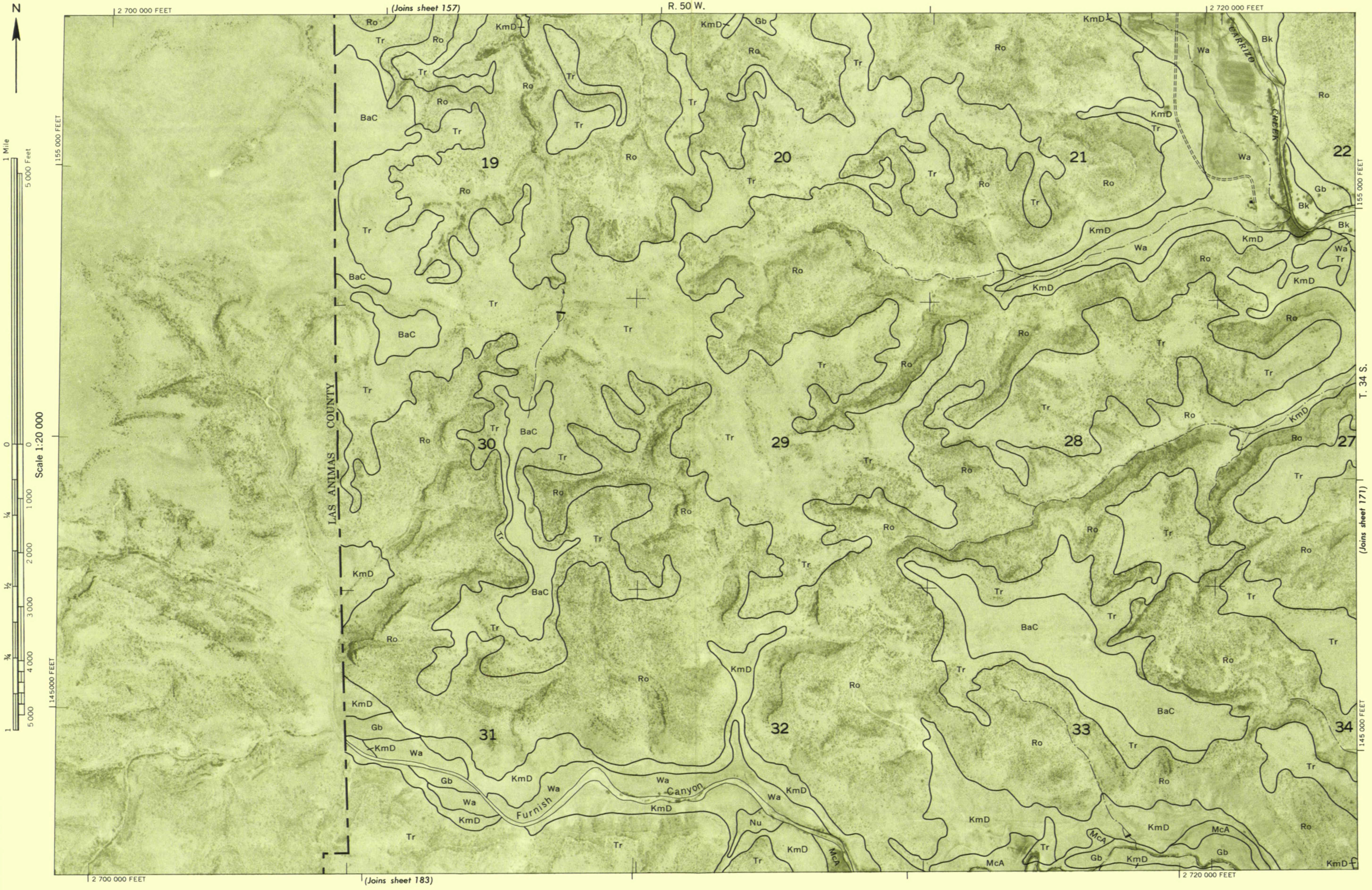
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 169

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.



BACA COUNTY, COLORADO — SHEET NUMBER 170

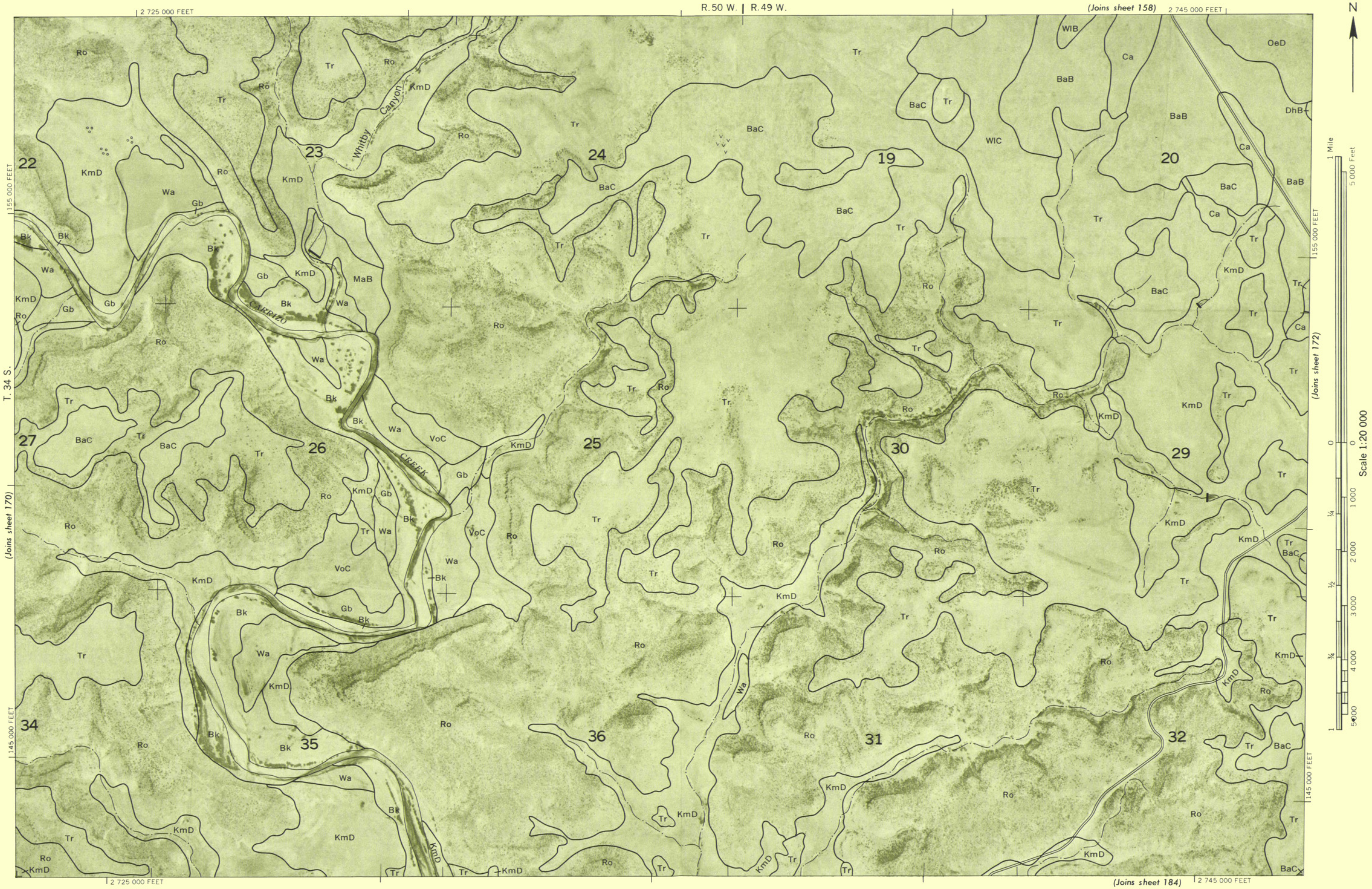


Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 170



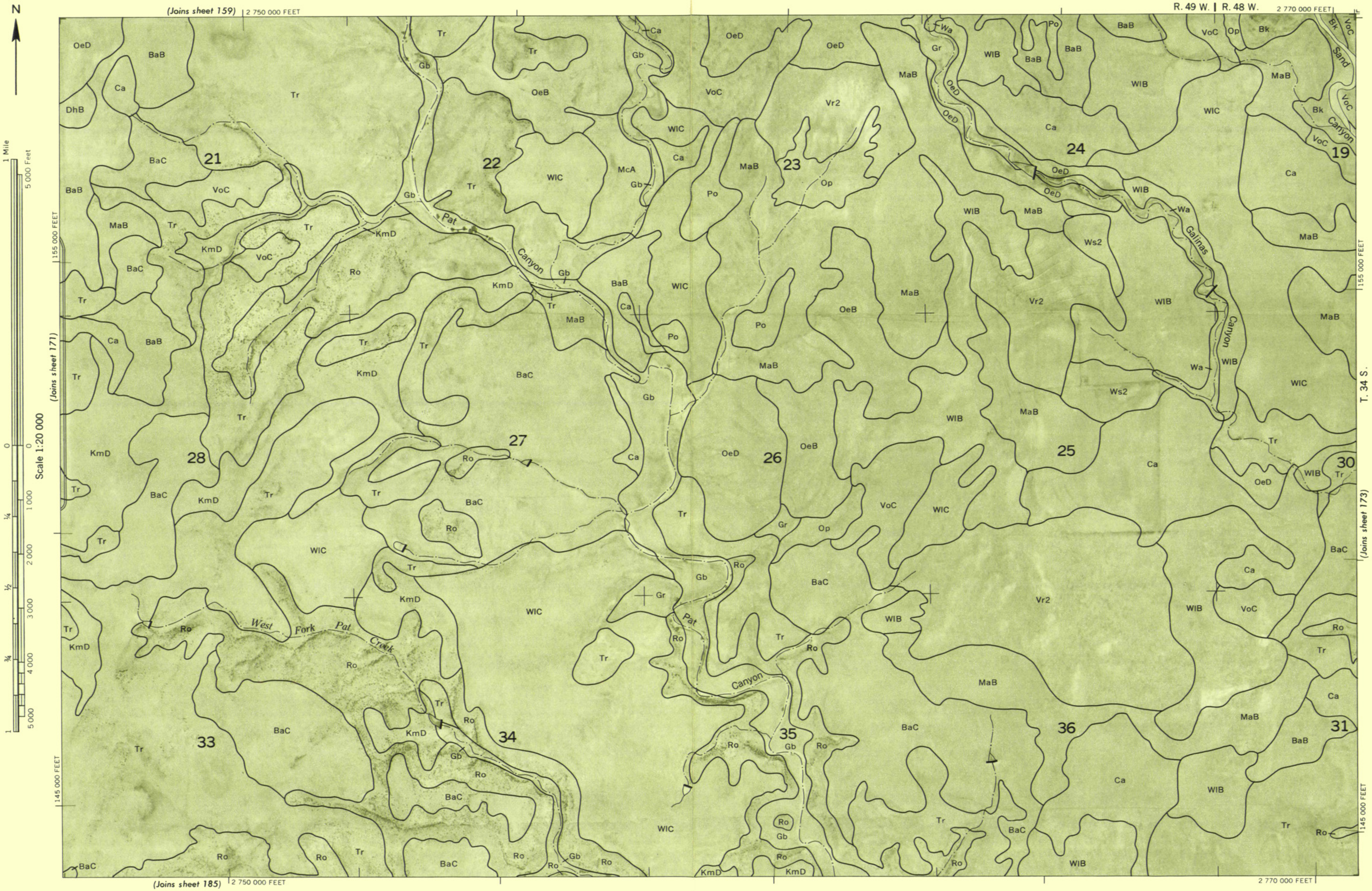
BACA COUNTY, COLORADO NO. 171

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 172



Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 172

BACA COUNTY, COLORADO, NO. 173

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

N

1 Mile
5 000 Feet
Scale 1:20 000
0 ¼ ½ ¾ 1
0 1 000 2 000 3 000 4 000 5 000

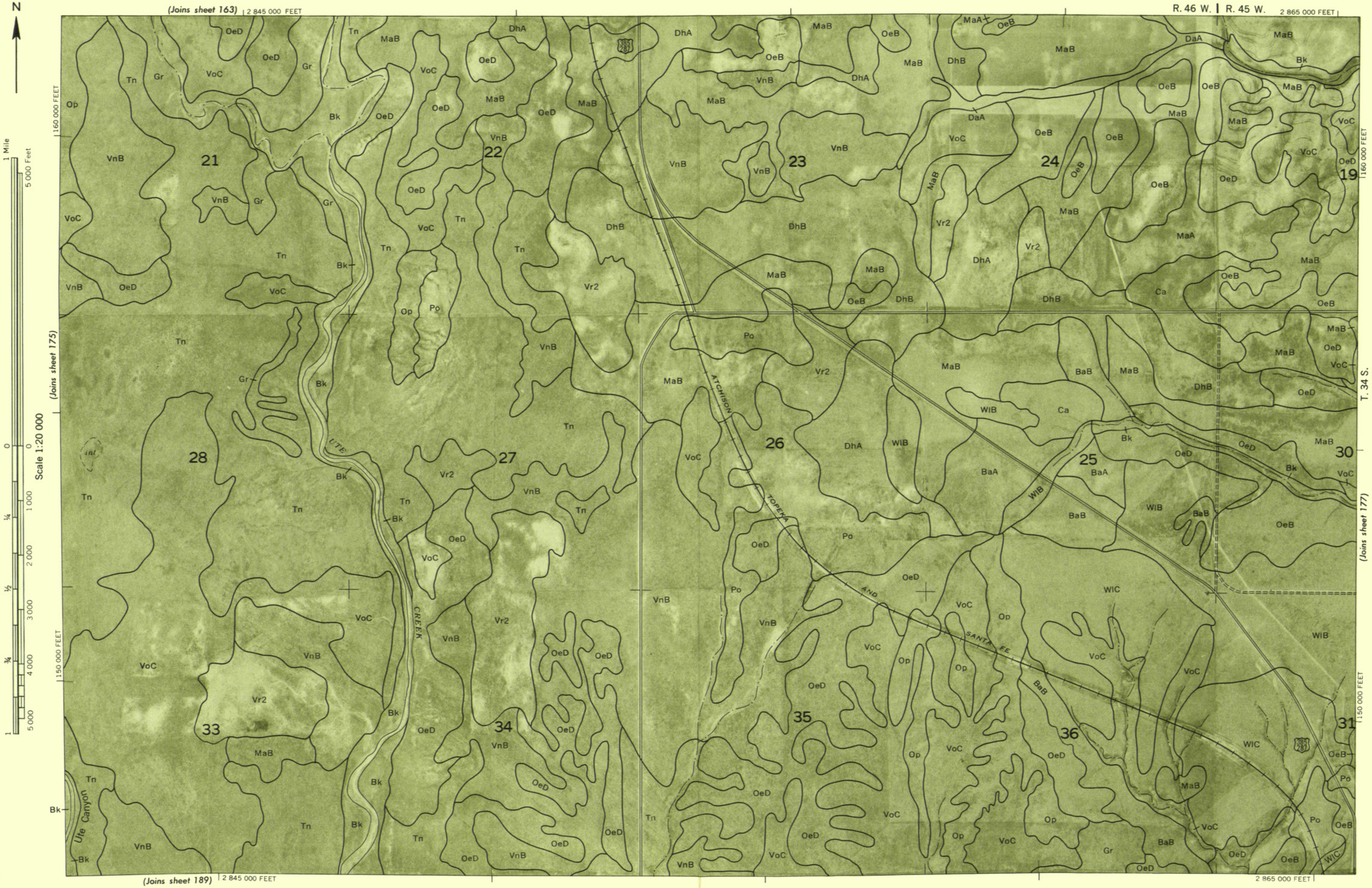
Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

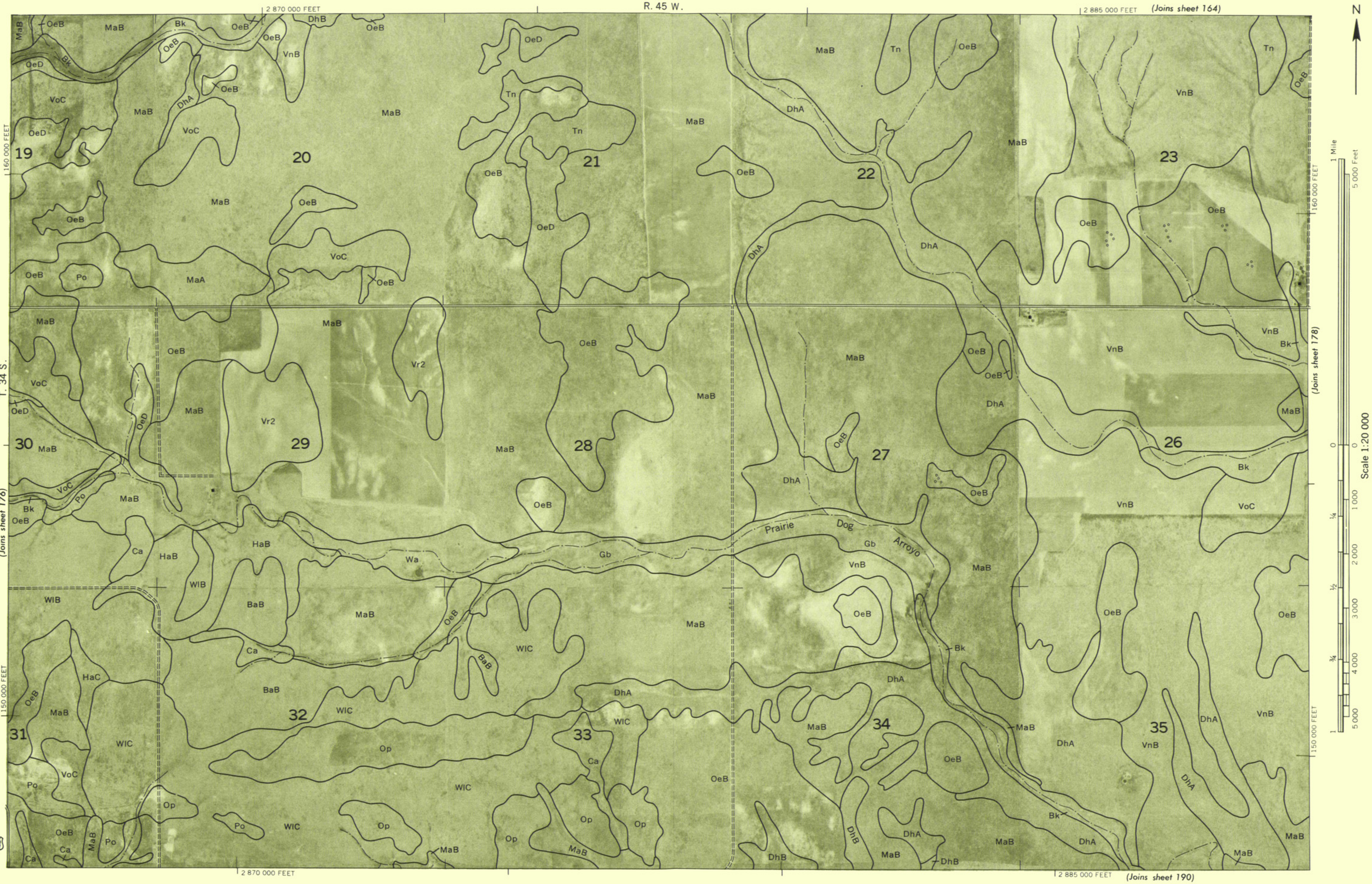
BACA COUNTY, COLORADO NO. 175
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 176



Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO — SHEET NUMBER 177



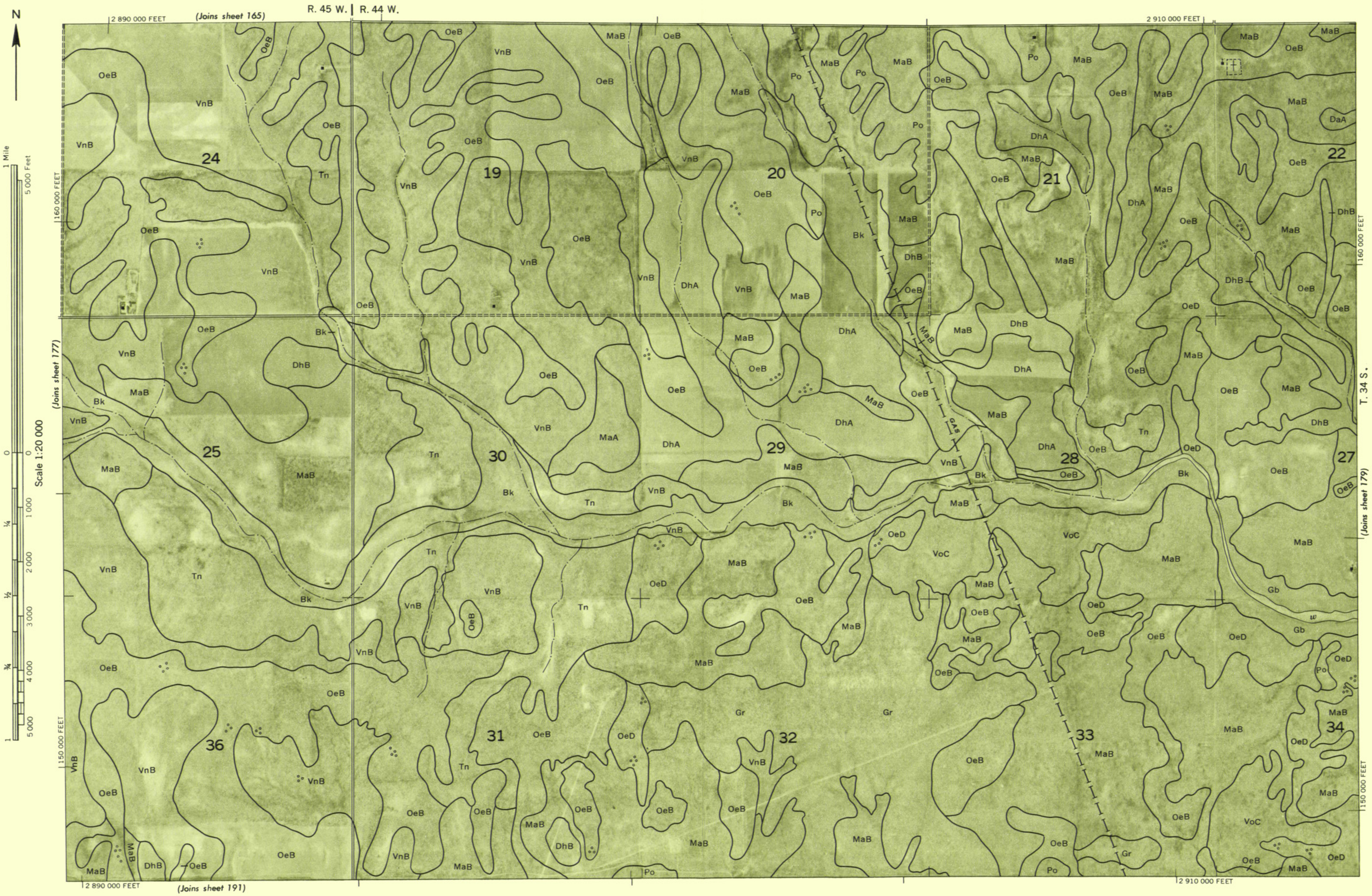
BACA COUNTY, COLORADO NO. 177

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 178



Land division corners are approximately positioned on this map.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

179

BACA COUNTY, COLORADO NO. 179

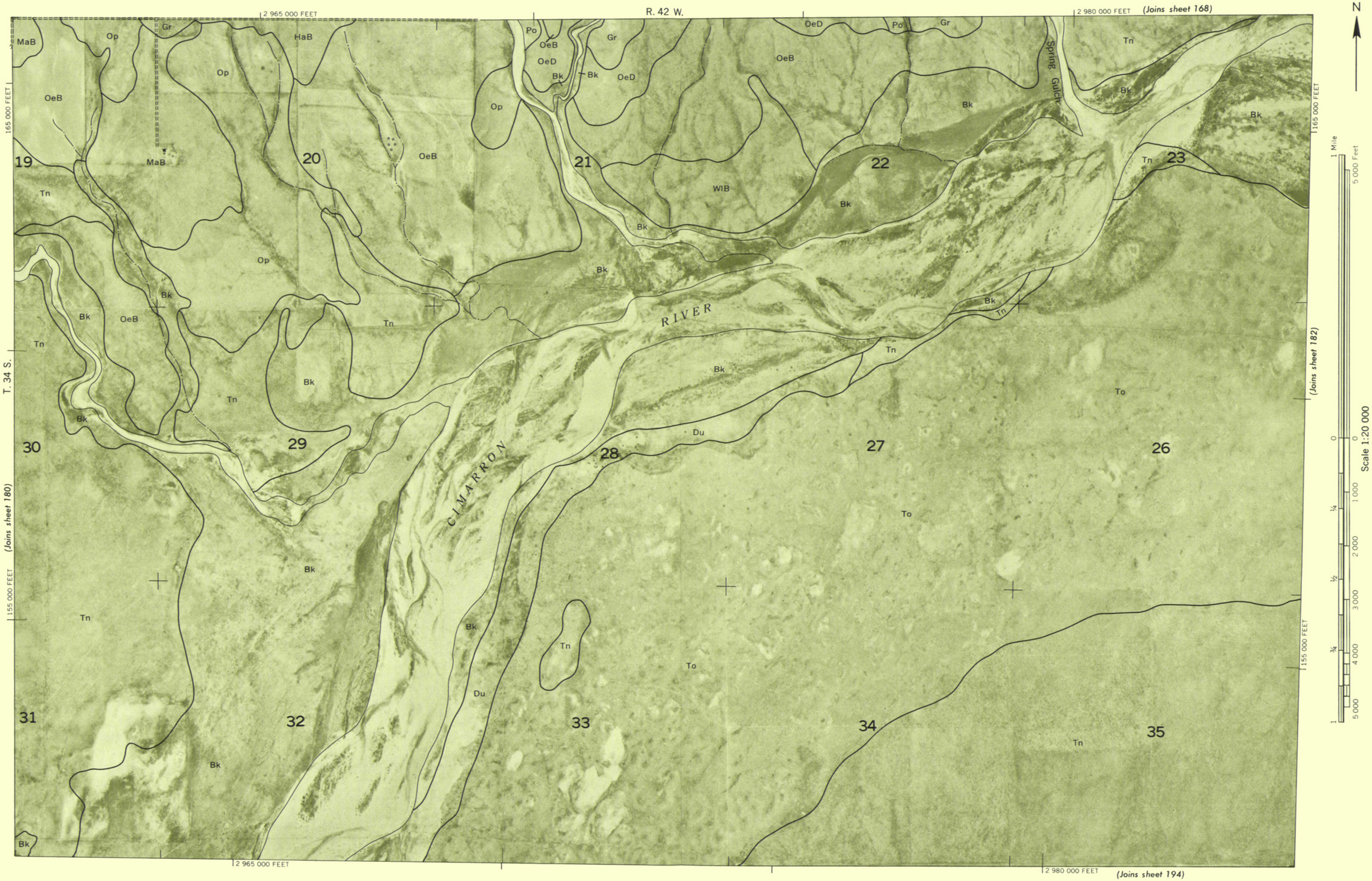
This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 180

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.



BACA COUNTY, COLORADO NO. 181

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 182

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 183

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum

Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 184

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 197_ as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 185

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station. Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum. Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 186

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 187

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 188

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

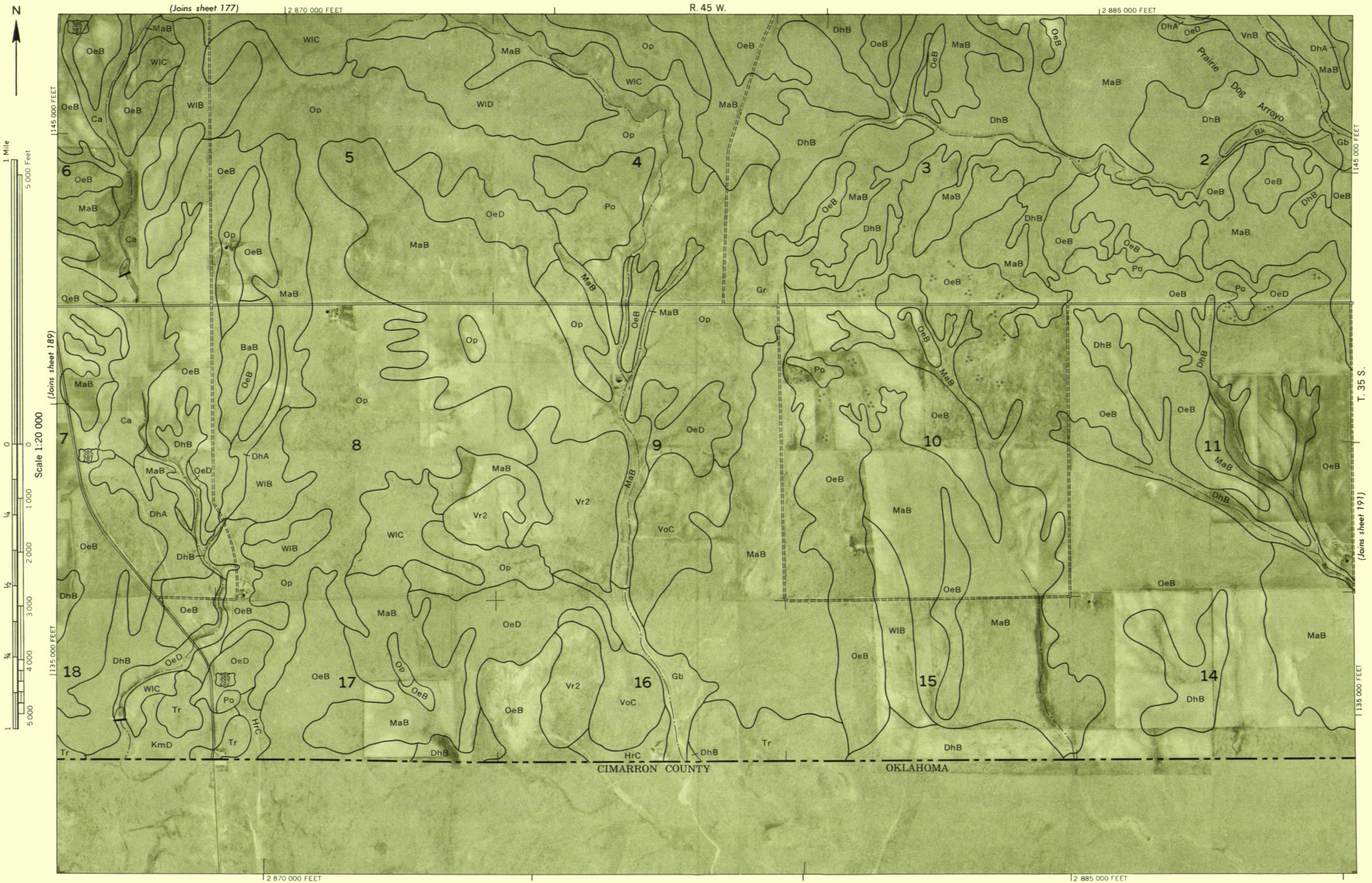
189

BACA COUNTY, COLORADO NO. 189

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

(190)

BACA COUNTY, COLORADO — SHEET NUMBER 190

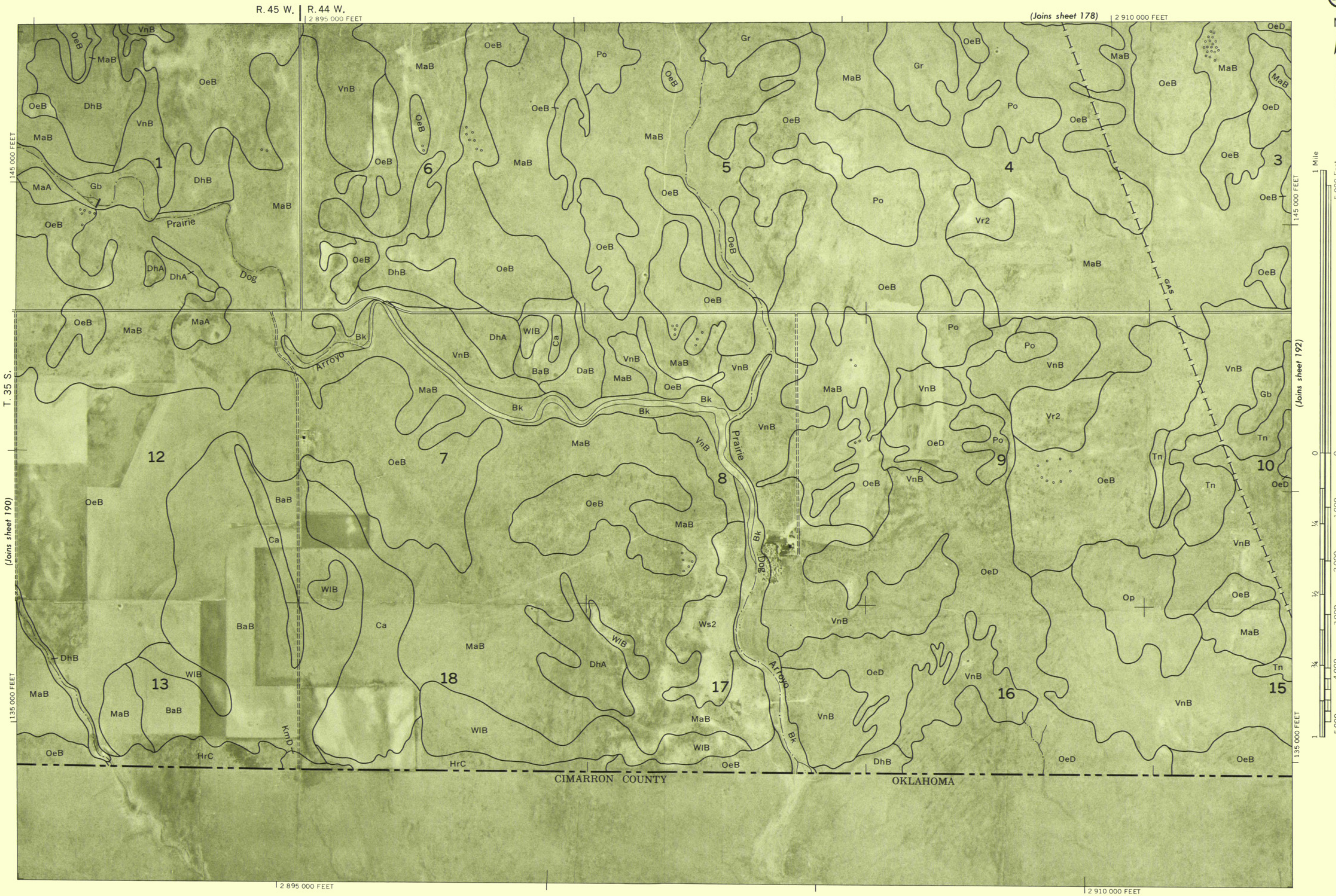


Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 190

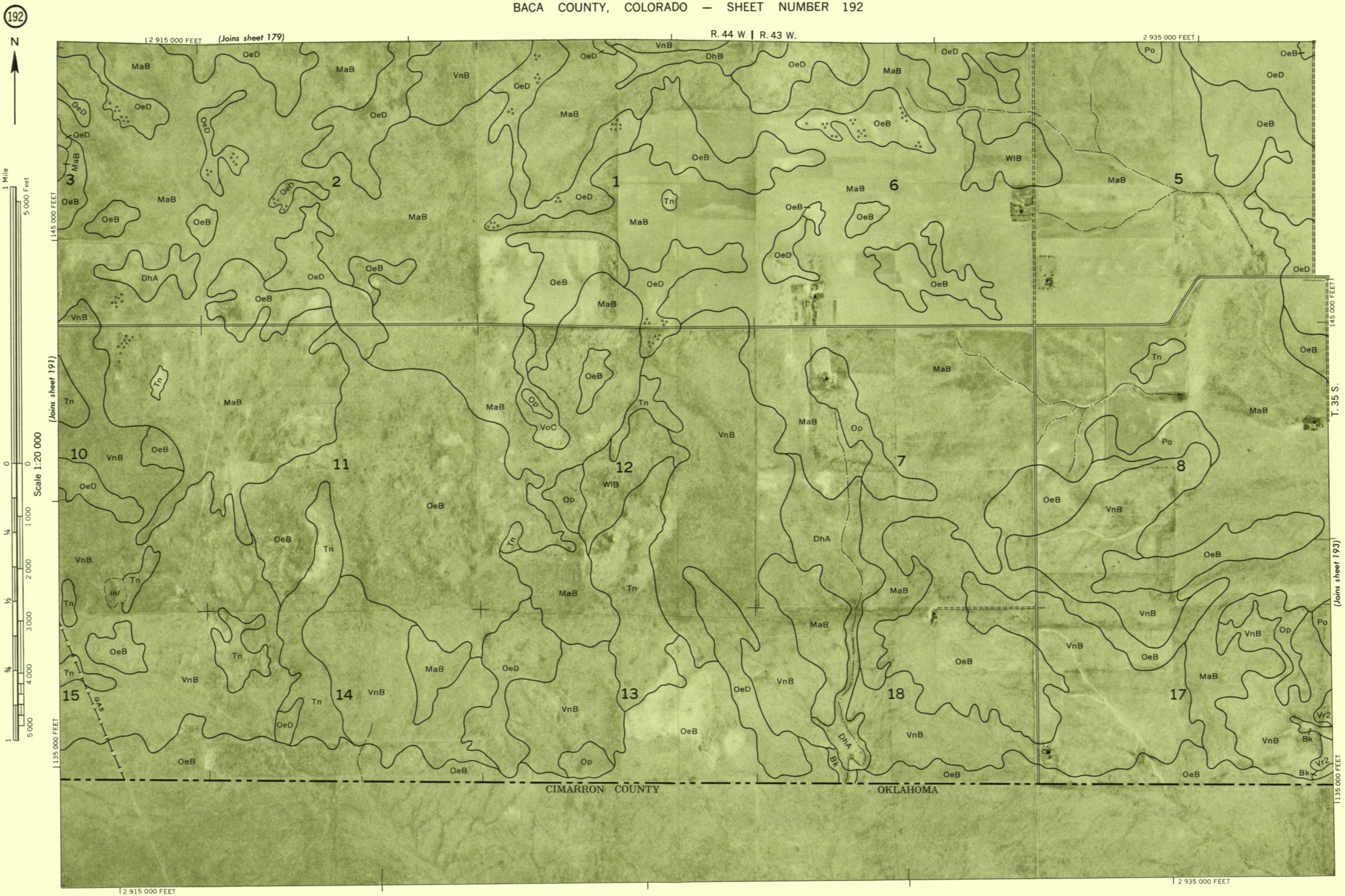


BACA COUNTY, COLORADO NO. 191

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado co-ordinate system, south zone, 1927 North American Datum.

Land division corners are approximately positioned on this map.



Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 192

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BACA COUNTY, COLORADO NO. 193

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000 foot grid ticks based on Colorado coordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.

BACA COUNTY, COLORADO — SHEET NUMBER 194

N

Scale 1:20 000

Land division corners are approximately positioned on this map.

Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.

BACA COUNTY, COLORADO NO. 194

BACA COUNTY, COLORADO NO. 195

This map is one of a set compiled in 1970 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Colorado Agricultural Experiment Station.
Photobase from 1964 aerial photographs. 5000-foot grid ticks based on Colorado co-ordinate system, south zone. 1927 North American Datum.
Land division corners are approximately positioned on this map.